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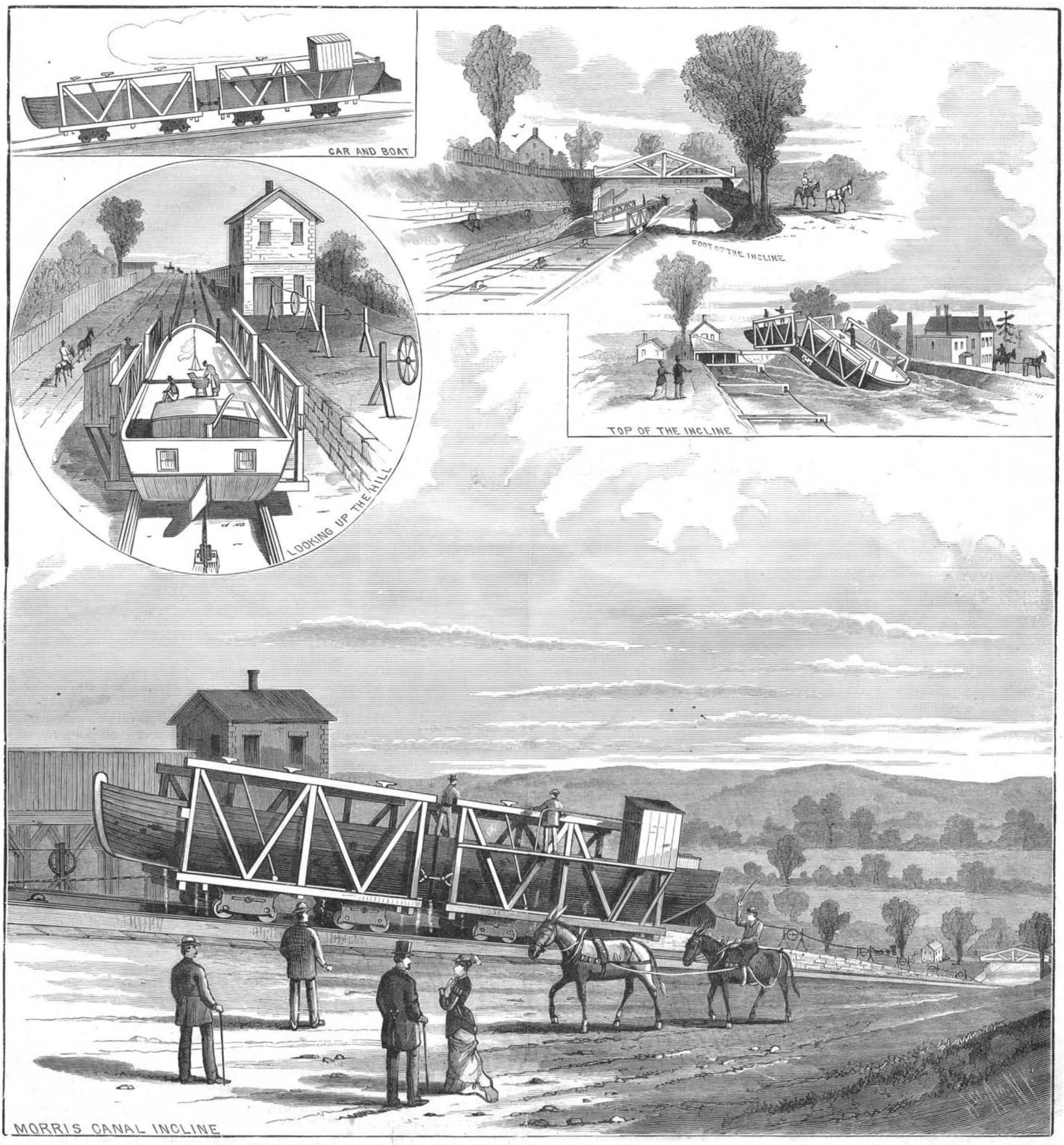
HYDRAULIC LIFT ON THE MORRIS CANAL.

In passing from the waters of the Hudson River, opposite New York, to the waters of the Delaware River, opposite Easton, Pa., by the way of the Morris Canal—a distance of 103 miles—the boats are carried over hills to the altitude of 760 feet above tide water level.

There are two methods of raising and lowering boats in use on this important coal route, one being the usual lift lock, in which the boat is floated into a narrow masonry passage having movable gates, which are far enough apart to receive the boat, so that, by admitting water from above the inclosed level, the boat is raised and floated into the upper canal level. The other plan, which forms the subject of our illustration, is to haul the boat and its cargo up an incline upon a car.

The termini of the canal levels at Bloomfield, N. J., are separated by an incline about 1,600 feet long and 60 feet high. The canal boat is taken from the lower level and deposited in the upper level by a double car, or rather two cars coupled together, each of sufficient width and length to support one of the halves of the bisected canal boat. A track, consisting of two heavy rails 12 feet apart, guides and supports these cars with their load. A wire rope of 3 inches diameter winding upon a drum 13 feet in diameter draws the car up the incline.

This huge drum is revolved by a turbine water wheel 4½ feet in diameter, placed in the wheel house half way down the incline. The turbine is supplied with water from the upper level and discharges into the lower level. The operation of transferring a boat from one level to another is very rapid; we are informed that four minutes is the usual time for making the transfer. The car not only enters the water below to receive the boat, but enters the water of the upper level to allow the boat to float off. One of our views shows a boat entering the water of the upper level. There are twenty-three of these inclines upon this canal and twenty-four ordinary lift locks. Three of the inclines are double. This lock at Bloomfield gives an idea of the facility with which ponderous bodies may be handled by exceedingly simple means.



HYDRAULIC LIFT ON THE MORRIS CANAL, AT BLOOMFIELD, N. J.

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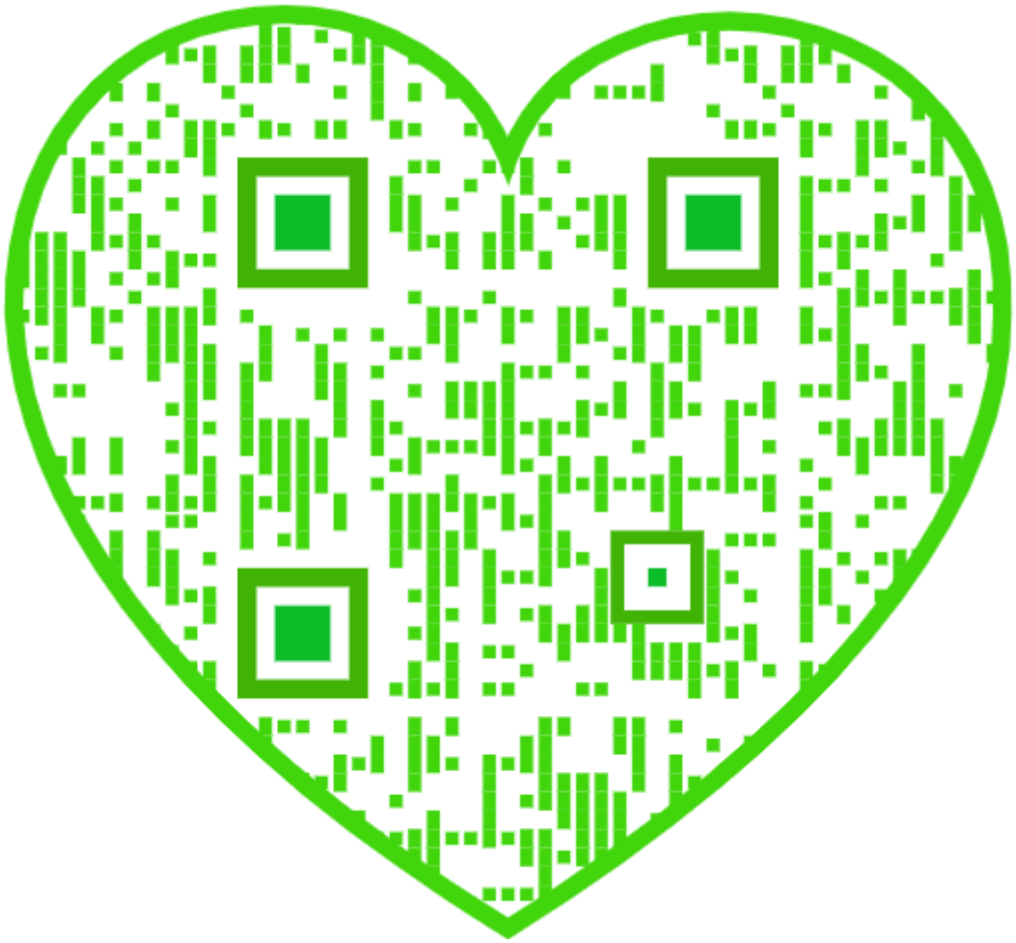

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NEW YORK, SATURDAY, MAY 20, 1882.

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KLINKERFUES' WEATHER COMPASS.

It is well known that the barometer only becomes a guide to forecast the weather when it is taken in combination with the hygrometer. To combine the advantages of both, Professor Klinkerfues, of Goettingen, has devised a new form of instrument, to which he gives the name of "weather compass." Although not without its faults, this instrument, says the *Polytechniches Notizblatt*, is suitable for ordinary use, and will probably supplant the barometer as a weather glass. It is in fact a kind of barometer resembling Bourdon's aneroid barometer combined with a hair hygrometer, which acts upon the pointer that indicates the atmospheric pressure, so as to increase or diminish its motion according as there is a greater or less amount of moisture in the air. Beside this, the direction of the wind is also taken into account according to the influence which experience has shown that the wind has on the state of the sky, and atmospheric precipitation. For example, observations extending over many years have shown that the change from west to east improves the weather prospects on an average about as much as a rise of 9 millimeters (three-eighths of an inch), or a decrease of 50 per cent in relative moisture. A change from east to west has a correspondingly bad effect.

This new weather glass gives us, in the simplest possible manner, information regarding the weather to be expected in the next 12 to 24 hours, whether a clear or clouded sky, dry or wet weather. But this is the most important thing that we wish to know beforehand, if it is only approximately correct and reliable. Out of 100 forecasts about 90 are correct. This kind of prognosis has the advantage of being local, and therefore is especially valuable to farmers.

The weather compass compensates for the action of the barometer and hygrometer in such a manner that a falling of the barometer with a decrease of relative moisture, or a rise of barometer and with an increase of relative moisture, acts upon the pointer in opposite directions, and if one is proportional to the other, keeps it at rest. The basis for the calculation of the dial of the instrument is the simultaneously observed variations of the barometer and hygrometer and the relations between atmospheric pressure and moisture, namely, 1 millimeter of pressure is equal to 6 per cent of relative moisture. Thus pressure and moisture, direction of the wind, and present weather, become factors in determining the weather, and are rated at their proper worth. On the face of the campass is a small revolving disk, on which is marked east, N. E., N. W., S. E., S. W., west, for the direction of the wind. Around the circumference of the larger disk are the words wet, very wet, dry, clear, etc. There is also a pointer or index, which extends inward from the edge of the face. To set the instrument, it is only necessary to turn the two disks so that the pointer will point to the present state of the weather on the weather disk, and to the present direction of the wind on the wind disk. This is evidently necessary, because regard must be had to whether one and the same change will lead to wet or to dry weather. In 10 or 12 hours, if the direction of the wind remains unchanged, the pointer will indicate the coming weather directly. If there is a change in the wind in the meantime, then the outer or weather disk must be turned so that the state of the weather at that time will correspond to the new direction of the wind. This will bring the weather that is to be expected under the pointer. The price of the weather compass in Frankfort is about $12.50.

SUFFOCATION BY COAL GAS.

Cases of poisoning by illuminating gas are sufficiently frequent to make one suppose that greater care would be taken to prevent their recurrence. Not long since a man in this city attempted suicide by means of gas which he inhaled through the mouth, but the timely interference of neighbors prevented its having the intended effect. A few days later a Fall River steamer came to her pier with two of her passengers insensible from the same cause. Coal gas contains from 5 to 9 per cent of carbonic oxide, to which its effects are chiefly due. M. Tourdes says that *pure* coal gas is instantly fatal, but the case of attempted suicide, as well as the rare occurrence of fatal poisoning in gas works, where workmen are sometimes exposed to gusts of undiluted gas, makes this seem at least doubtful. The same authority says that one-eighth of gas will kill a rabbit in five minutes, and one-fifteenth in ten to fifteen minutes. In one case that proved fatal Dr. Taylor estimated the quantity at 3 per cent. Even small quantities, which are only perceptible by their odor, cause unpleasant symptoms, headache, and nausea, if inhaled for a long time. Time seems to be an important factor in gas poisoning, for in most cases where persons are exposed to its influence for a few hours they can be resuscitated, but if left a longer time this is not possible.

Carbonic oxide, as already stated, is credited with being the principal factor in gas poisoning, a question that could be quickly settled by the spectroscopic examination of the victim's blood. Two of the large gas works in this city supply us with gas still richer in carbonic oxide, sometimes reaching 25 or 30 per cent. It was expected that this would prove particularly fatal to its users, but accidents have thus far been fortunately few, which may perhaps have been due in part to its vile odor, which serves as a warning.

One of the most convenient safeguards against possible poisoning by gas is to sleep with an open window where fresh air can always enter to dilute it in case of any escape. A person has been known to sleep in safety the entire night in a room where the deadly (?) water gas was escaping from an open cock at full head, the secret of his escape being the open window. Attempts have been made to construct automatic alarms that should report escaping gas, but none of them are so efficient as might be desired, are liable to get out of order, and are not likely to awake the person who is destined to be the victim.

METALLIC CÆSIUM.

For the past thirty years chemists have been anxiously waiting for somebody to isolate the metal cæsium, which, with rubidium, was the first discovery made by the aid of the spectroscope. Bunsen prepared rubidium, as he has so many other metals, by the eloctrolysis of its salts, but he did not succeed in obtaining cæsium. So great is its affinity for oxygen and the metalloids that it is placed at the positive end of the list, the most electro-positive of all metals. From Liebig's *Annalen* we learn that C. Setterberg has succeeded in preparing metallic cæsium by the electrolysis of a mixture of the fused cyanides of cæsium and barium. It is a silver white metal, very soft and ductile, nearly twice as heavy as water (specific gravity 1·88), and melts at 29·5° C. (85° Fah.), so that it resembles gallium in this point. It takes fire spontaneously in the air, and if thrown upon water burns like potassium and rubidium, to which it is most nearly related. The color of the flame is not stated. If true, this will be the first metal known that takes fire in the air, although all the alkali metals oxidize rapidly.

Ammonia from its Elements.

Numerous methods have been devised to utilize the atmospheric nitrogen for making ammonia. The latest of these is a French process in which metallic zinc is employed to furnish the elements titanic iron to effect their union. Melted zinc falling into water sets free the hydrogen, falling through the air it liberates nitrogen, oxide of zinc being formed in both cases. The nitrogen is passed over titanized spongy iron, and is absorbed by it. When the hydrogen is passed through the retorts containing this spongy iron it will release the nitrogen from the titanium and combine with it to form ammonia. The oxide of zinc is reduced in retorts with carbon, and carbonic oxide is set free, which needs only to be burned in order to convert it into carbonic acid, which is then allowed to combine with the newly-formed ammonia to form a carbonate. Or, platinized pumice or charcoal are substituted for the spongy iron and the gases made to act upon it under 10 to 15 atmospheres of pressure. C. Z.

THE PARASITE OF THE CLAM

BY C. F. GISSLER

We often meet in opening the shells of the "long clam" (*Mya arenaria*) with a whitish, more or less semi-transparent worm, which Professor A. E. Verrill described under the name of malacobdella obesa.

It is about thirty millimeters in length and some thirteen to fourteen millimeters in width. It has a nearly circularly round sucking disk on the under side of its hind or posterior end, resembling, therefore, and is generally taken for a sort of leech. In reality it belongs to the kind of worms called *nemertines*. Its front or anterior end has no sucking disk, as is the case with all kinds of leeches, and its internal structure or organization is also widely differing from that of the leeches.

The under or ventral side of this curious worm is smooth and flat; above the body is slightly convex and transversely wrinkled. Between and on the wrinkles are innumerable very minute spots and rings, looking like openings. Its head or anterior part appears as if cut off and hollowed out to some distance of the body. It moves but very slowly its sides in a peculiar wave-like manner, and occasionally contracts its whole body. Under the microscope we perceive that its whole exterior surface is covered with extremely fine and short hairs or ciliæ, which are seen to move rapidly in certain directions. These fine hairs can only be seen with a compound microscope, and present to the eye a very fine and interesting object; very small pieces cut off from the side of the worm still show the motions of those hairs for some time.

If we place live specimens of the clam parasite into strong alcohol we notice that some of them protrude a small cylindrical organ a little above the mouth on the upper or dorsal side of the animal; this is the proboscis or tusk. Its hinder end is inclosed in a small sac in the body of the worm, into which sac this tusk can be withdrawn. The mouth is situated not in this tusk, but below it on the front or head part of the worm; meandering through the body is the alimentary canal or stomach and intestine. The intestine is convoluted or folded about six or seven times, until it reaches the extreme hind part, terminating in a small orifice or opening on the upper side, just above the sucking disk.

They probably live on the same food the clam lives on; that is, small particles of organic matter, such as the lowest organisms, infusorials, wheel-animalcules, etc., which abound on the bottom of the sea. These clam parasites have no eyes, as do most parasitical animals.

Our parasite occurs in the branchial or gill cavity of the "long clam," and has been found to occur in Massachusetts, Connecticut, New York, and New Jersey. Another different kind, the *Malacobdella mercenaria*, occurs in the "round clam" (*Venus mercenaria*); it is somewhat smaller and narrower, but of the same color and general appearance. Oystermen usually do not throw them away when they find them, as it is positively known that they do no harm whatever in the human body.

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Cremation.

BY DR. SAMUEL KNEELAND.

The four principal ways of disposing of the dead have been: First, mummification; second, burning; third, interment; fourth, aerial exposure. Of the first, practiced chiefly by the ancient Egyptians, and of the fourth, by many savage nations, I need say nothing at this time.

In most nations, savage and civilized, from time immemorial, it has been the custom to inter the bodies of the dead in the ground, or to seal them up more or less tightly in tombs. Though these may answer all sanitary purposes, and fulfill all the sacred obligations of the living to the departed, in scattered populations, they are attended with danger, always increasing in populous communities.

This danger has practically been recognized by the fact that cemeteries have generally been placed without the limits of thickly inhabited districts. When persons, dead from infectious diseases, are buried in graves, they leave behind them to the public, as residuary legatees, a fearful amount of danger; and faithfully and impartially is the deadly legacy divided among all dwelling within a circle of one thousand to three thousand feet of such graves. Earth will, to a certain extent, deodorize, but cannot destroy or impede the escape of minute poisonous germs.

The danger from this source has never been fully appreciated by the public, entirely ignorant of the process of decomposition, and the products thereof. Of course, the decay of the body committed to the grave depends as to rapidity entirely on the soil and temperature. In the Arctic regions decomposition is imperceptibly slow; in dry, torrid sands desiccation takes the place of putrefaction, and a kind of natural mummification takes place. In low, damp, or wet soils, in temperate zones, decay may be complete in one to one and one-half years, giving off deleterious gases for that length of time, with perhaps the seeds of contagious disease. In dry, high, and airy soils the process is much slower and less dangerous.

What is decomposition of the human body? What are its products? What its dangers?

An English writer has defined the human body, chemically, as 45 pounds of carbon and nitrogen dissolved in 5½ pailfuls of water. Oxygen, though the principle of life, is also the great destroyer; the moment life ceases, our carbon by its agency is converted into carbonic acid, which escapes into the air, or is taken up by the roots of plants, according to the mode of sepulture; our nitrogen combines with some of the hydrogen of decomposition, forming ammonia, which escapes in a similar way; the water which forms about two-thirds of our weight is lost by evaporation. We are resolved, therefore, into gases, and the only dust which remains behind is the four or five pounds of lime salts which constitute our bones and hard parts. Nature provides sufficient animate and inanimate agents for the removal of decaying animal substances in the air, on the ground, or just beneath its surface, and the more speedy in the hot and damp climates where the results of decomposition are the most deleterious, provided man in his folly do not interfere with her processes. Man, by his mode of interring human bodies, contrives to prolong as much as possible the decay of his deceased brethren, thereby increasing to the utmost the possibility of poisoning the air, infecting the earth, and contaminating the water in the neighborhood of living beings. Air and surface burial permit free access to the myriads of minute living creatures whose office it is to convert into their own harmless substance the bodies of dead animals and man.

In the grave of six feet or more in depth light and air are in great measure excluded, and there is no access to the insects from whose eggs emerge the grubs or worms, from whose jaws popular belief expects the rapid and total destruction of the body. The truth is that the devouring worm is a myth, as much without foundation as the "dust" into which we are supposed to be resolved, and the results of decomposition are horrible enough in reality without adding any imaginary sensational accessories.

The modern process of cremation is performed as follows: The crematory at Washington, Pa., is a brick structure one story high, thirty feet long, twenty feet wide, divided into two rooms, a reception room twenty feet square, including walls, and a furnace room twenty feet by ten feet, including walls. Cremation is performed in a fire clay retort, such as is used in the manufacture of illuminating gas, but of a somewhat different shape, heated to a red heat before the body is introduced, which work requires about twenty-four hours. The body is placed in an iron crib made in the shape of a coffin, with small round rods, with feet three or four inches long to keep it up off the bottom of the retort. These feet are inserted into a flat strip of iron two inches wide and a quarter inch thick, turned up at the ends so that the crib with the body will slide into the retort easily. In addition to the ordinary burial garments, the body is covered with a cloth wet with a saturated solution of sulphate of aluminum (common alum), which, even when burned, retains its form, and prevents any part of the corpse from being seen until the bony skeleton begins to crumble down. During the cremation there is no odor or smoke from the consuming body, as the furnace is a self-consumer of smoke and other vaporable matter. The time required to complete the operation is about two hours, but improvements in the process will doubtless shorten the time. A very small portion of the remains is ashes, but the mass is in the form of calcined bones in small fragments, very white, odorless, deprived of animal matter, and may be preserved any length of time without change.

There are four to seven pounds of these remains from various sized adult bodies; they can be placed, for preservation, in a one-gallon druggist's bottle, with large ground stopper, into which a photograph of the deceased, with appropriate record, can be placed before introducing the remains. This bottle can be placed in the *columbarium* of the crematory, kept among the cherished memorials of the family of the deceased, or placed beside other remains previously buried in cemeteries or graveyards.

This building, with its appliances, cost about $1,500. A plainer one, equally efficient, could now, at the reduced cost of labor and materials, be built for $1,000. An impression prevails that this crematory was erected for public accommodation, and that the owner of it follows cremation as a business for fees. This is a mistake. It was built for the use of its present proprietor and friends in the vicinity who concur with him in this reform. No fees have been charged, nor ever will be while in his possession.

A not unimportant item in this process is the great diminution in the expense of funerals. The average expenditure for each body buried is $100, the average cost by cremation is $20; the aggregate saving in the United States, from the adoption of this system would annually amount to millions of dollars. The expense of cremation is less than that of an ordinary burial case.

Cremation certainly is not barbarous, for it never entered, nor could it enter, into the heads of barbarous people. It is not burning; there is no pile of wood or other combustibles, no visible flame, no smoke, no sickening odor; it is a process of great scientific skill, the reduction of the body to ashes by the application of intense heat, 1,000° to 2,000° Fahr., by which it is resolved into its chemical elements at once, and without the flame coming into contact with the body.

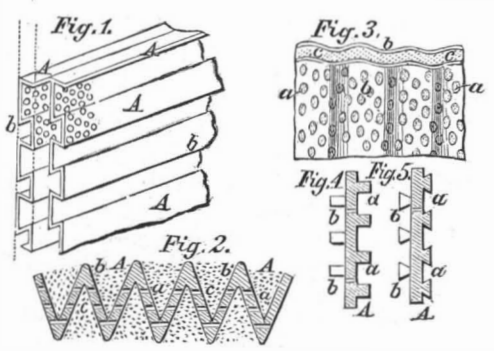
We are all, more or less, carried away by our emotions and sensibilities, especially in the matter of the treatment of the bodies of our dear ones. As rational beings we must not allow our instincts and emotions to run away with our reason, especially in a matter as important as this.

The history of cremation in the United States is very brief, as the progress of such a radical change in long-established customs must, of necessity, be slow. The earliest known instance was of Colonel Henry Laurens, in South Carolina, in 1796. Including that, to the present time not more than eight, or possibly ten, cases have occurred, the last in the current year, and three or four in the crematory at Washington, Pa. Among those who left instructions for the disposal of their remains by cremation was Dr. Charles F. Winslow, of California, a former member of the Society of Arts, whose body was cremated about five years ago, in Salt Lake City, in a temporary furnace erected by his command, by the administrators of his estate. The Washington, Pa., crematory has had nearly one hundred applications, which have been declined, as the trustees do not intend to follow it as a business. They will permit only an occasional cremation there for the purpose of keeping the subject before the public, and of hastening the disappearance of the prejudice which exists against this mode of disposing of the dead. It is believed by them that similar structures will be built at other places, and they will furnish for such laudable purpose any information which their experience enables them to give.

Leaving out of the question, then, all but sanitary reasons, cremation is far preferable to earth burial; and we cannot but think that by degrees this reform will supplant prejudiced superstition, the pomp and profits of undertakers, and give to the living that immunity from many diseases, arising from foul air, impure water, and poisoned earth, which they are entitled to receive from the progress of sanitary science.—*Proc. Soc. Arts, Boston.*

The Sellon Secondary Battery.

Last week we gave an engraving of the form of this battery, now in use with much success at the Electrical Exhibition, Crystal Palace, London. We now subjoin additional illustrations, taken from the English patent of Mr. J. S. Sellon, No. 3,926.



The invention relates to "the use in the construction of secondary batteries of perforated plates or sheets roughened, serrated, or indented, composed of lead, platinum, or carbon, upon, in, or against which plates spongy or finely divided lead, or other salts or compounds of lead, or other suitable substances or compounds are, or may be, held or retained." Fig. 1 represents a perspective view of a perforated battery plate, formed of dovetail section. Fig. 2 shows a section of a perforated plate formed with angular projections or grooves. This plate may be bent into a rectangular or cylindrical form. Fig. 3 shows an irregular section of a compound battery plate formed of two or more plates which may have flat or irregular surfaces. Figs. 4 and 5 illustrate a plate cast with slits and projections, the latter of which are flattened or riveted over during manufacture to cause the retention of the metallic oxide. A A are sheets or plates of lead, platinum, or other material, so formed that a large quantity of spongy or finely divided lead may be retained in or against them in such a manner as to be readily acted upon by the electric current. The plates may be formed of corrugated lead, or of lead cast with holes, *a*, either plain or with flutes, corrugations, indentations, or projections, *b*, in or on which the material, *c*, can be packed. In Fig. 3 the oxides are placed between the sheets, which are riveted or soldered together.

DECISIONS RELATING TO PATENTS.

Supreme Court of the United States.

HEALD *vs.* RICE.—STRAW-BURNING BOILERS.

Decided March 6, 1882.

In error to the Circuit Court of the United States for the District of California.

This was an action at law brought by Rice to recover damages for an alleged infringement of reissue letters patent No. 6,422, granted May 4, 1875, to him for improvements in steam boilers. The original patent was No. 146,614, dated January 20, 1874. The invention, as stated in the complaint, consisted, among other things, of a combination of a straw-feeding attachment with the furnace door of a return flue steam boiler, for the use of straw alone as fuel in generating steam ample for practically operating steam engines. The case was tried by a jury and resulted in a verdict and judgment for the plaintiff, to reverse which this writ of error is prosecuted.

A bill of exceptions sets out the exceptions of the plaintiff in error to the rulings of the court below and all the evidence. The court was asked at the close of the plaintiff's testimony, and again when all the evidence on both sides had been introduced, to instruct the jury to return a verdict for the defendant, the refusal to do which, among other rulings, is assigned for error, and thus the whole case on the merits is brought here for review so far as they rest upon questions of law.

Mr. Justice Matthews delivered the opinion of the court. The findings in substance were:

1. REISSUE—PATENT WITH DRAWING—NEW MATTER.—In cases of reissues of patents, inoperative or invalid by reason of a defective or insufficient specification, or by reason of the patentee claiming as his own invention or discovery more than he had a right to claim as new, it is imperative that the new patent, when issued, shall be for the same invention, and that no new matter shall be introduced into the specification when, as in the present case, there is a drawing, with reference to which the invention is described.

2. SAME—COMPARISON OF PATENTS—QUESTION FOR COURT.—If it appears from the face of the instruments that extrinsic evidence is not needed to explain terms of art or to apply the descriptions to the subject matter, so that the court is able from mere comparison to say what are the inventions described in each, and to affirm from such mere comparison that they are not the same but different, then the question of identity is one of pure construction and not of evidence, and consequently is matter of law for the court without any auxiliary matter of fact to be passed upon by a jury if the action be at law.

3. SAME—STEAM BOILERS—DIFFERENT INVENTIONS.—In the present case it appears from the mere reading of the two specifications that the invention described in the first is for the return flue boiler, while that described in the second, abandoning the claim for the boiler itself, is for a particular mode of using it with straw as a fuel by means of an attachment to the furnace door for that purpose. These two inventions are distinct, and a patent originally used for one cannot lawfully be surrendered as the basis for the reissue for the other.

4. SAME—EXPANSION OF CLAIM.—The rule reiterated that a patent for a machine cannot be reissued for the purpose of claiming the process of operating that machine, because if the claim for the process is anything more than for the use of the particular machine patented, it is for a different invention. (*Campbell vs. James.*)

5. RICE PATENT ANTICIPATED BY MOREY PATENT.—The invention, moreover, is anticipated in Morey's patent, which, in covering the combination of the feeding tube with any kind of thrashing engine or boiler, necessarily includes the combination of the feeding tube with the return flue boiler. This particular application of the feeding tube to the return flue boiler is within the scope and provision of Morey's invention, whether it had been tested by his experience or was anticipated by his foresight or not.

The "Buffalo Gnat" of the Mississippi Valley.

This dreaded pest has appeared this spring in immense numbers in Eastern Arkansas, Western Tennessee, and Western Mississippi, and the great destruction of cattle, horses, and mules caused by it has added to the distress of the inhabitants of those sections of the country caused by the unprecedented floods. The particular species of *Simulium* in question has not been determined. As a cheap way of protecting animals, Professor Riley recommends to wash them once or twice each day, or oftener, if required, with water which has been left standing for several days over coal tar, or in which a small quantity of oil of tar, or oil of turpentine, or any similar material has been stirred.

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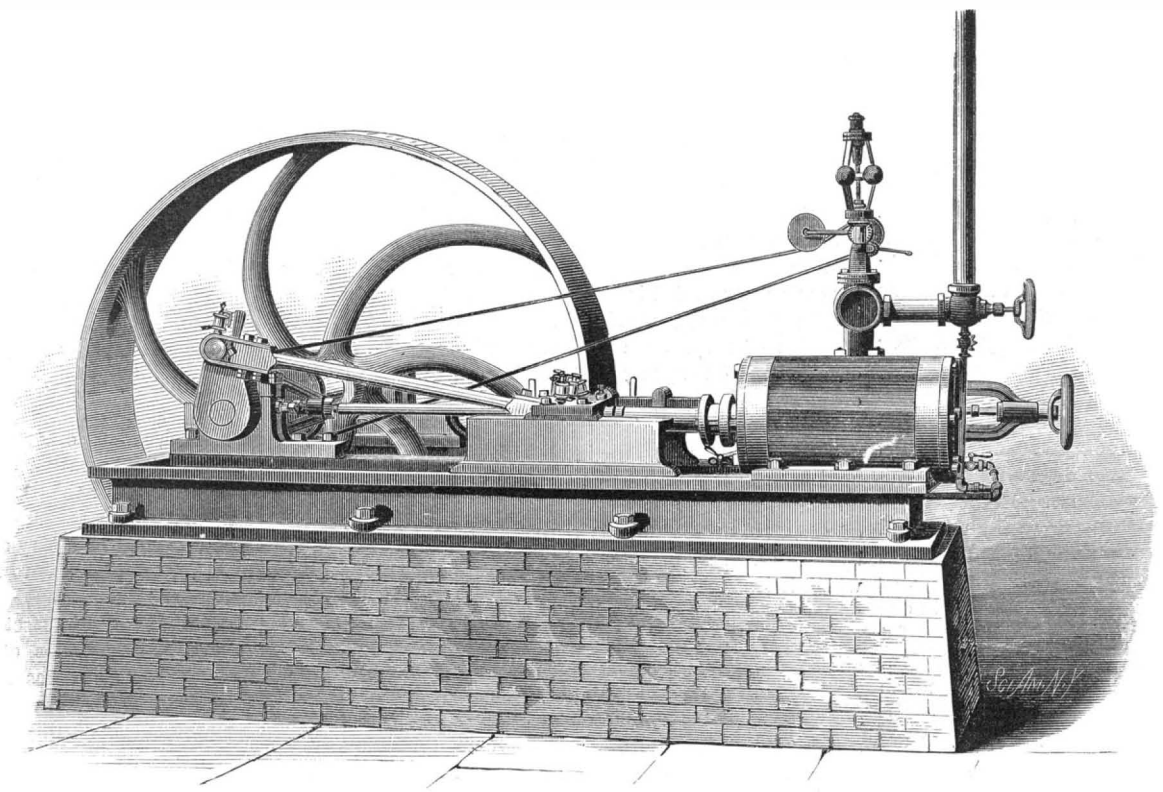
STATIONARY ENGINE WITH ADJUSTABLE CUT-OFF VALVES.

We give engravings herewith of a twenty-five horse-power engine, a representative of a line of engines manufactured by the Taylor Manufacturing Company, of Westminster, Md., and ranging in power from 12 to 250 horse power. For simplicity of construction and quality of workmanship and material employed, they are equal to any other make of engine. This engine is superior in the arrangement of valve gearing, which is shown in Fig. 3. This view represents the cylinder with the steam chest open, showing the main valve and cut-off valves with their connections; B is the main slide valve resting on its seat, showing port openings in each end; A A are the two cut-off valves resting on the back of the main valve; these valves are provided with brass nuts, having a solid collar on one end and two jam nuts on the other, for the adjustment of the nut in the valves and providing against wear. These valves are moved by stems, E and C, upon which are turned right and left hand threads; one end of stem E is secured to slide piece F by two locked collars, set to permit stem E to revolve in adjusting the valves; the end of stem C, that passes through the hand wheel, D, is provided with a key, so that by revolving the hand wheel the stems, C, E, revolve in the cut-off valves and spread them apart or draw them together according to the requirements of the cut-off; the pointer, I, indicating by a figured scale at what part of the piston travel the steam is being cut-off The bottom edge of the valves rests upon an inclined or beveled surface that keeps the valves to their proper seats and prevents them falling off and clattering when at work. The valves are driven by two eccentrics, the rods of which connect to the wrist pins, G and H.

The advantages gained by using two eccentrics are important, as the adjustment of both main and cut-off valves is independent of each other. The main valve, B, has a lap lead and exhaust closure appropriate to the value of the maximum cut-off, and permanently retains these relations throughout every variation in the point of cut-off brought about by the separation of the valves. The range of cut-off is from zero to six-tenths of the stroke, while the main valve acts in the interval and cuts off at eight-tenths of the stroke. It will be seen by the arrangement of the valves, A, that by closing them together they will be thrown out of gear and the control of engine left to the action of the main valve. The decided advantage in this cut-off is the positive results obtained, and the range of cut-off fixed upon while the engine is in motion, and the introduction of the steam to the cylinder positively fixed according to the requirements of the power. The variation of load is met by regulation of steam through a very sensitive governor, that is fitted with a double valve, and is also provided with a stop motion and speeder for varying speed of engine as desired without change of pulleys. With this combination of governor the valves are relieved of a considerable portion of the boiler pressure, but when a siding cut-off is the sole agent in the regulation it has no such protection, but must carry the full unrestrained boiler pressure constantly whether the load driven is heavy or light; and where such valves are actuated by springs or the governor, the friction is too great to be overcome by the spring, and consequently the valves are not reliable in their action. The throttling mode is preferable to the many styles of balanced valves, owing to the difficulty of keeping such valves in order and insure their perfect balance under all circumstances. The waste of steam that occurs from imperfect balanced valves is greater than the power required to overcome the friction of the valves as arranged in this engine.

The equalization of the cut-off is accomplished by adjusting the valves separately for the average position of the point of cut-off which will be practically equal to all points, and the closure of the steam port is necessarily equal for both strokes, whereas, with the usual automatic valve arrangement, the difference in velocity of piston travel, and actuation of valves by pendulum or spring governors, through the various connections, is so great that practically the point of cut-off will not positively occur equal, or promptly in both or a repeated number of strokes. and the steam follows the piston various distances many times unnecessarily, whereas, with the arrangement as shown, a positive point of valve closure can always be obtained, and with the governor to meet the variable load it is evident that a high degree of economical performance is secured. By a careful examination of the diagram taken with the Richards indicator from a 14x24 inch engine, it will be seen that the prompt admission, precise cut off, ready exhaust, required cushion, close approximation to the theoretic curve, commend themselves to the excellence of the valve movement.



TAYLOR MANUFACTURING COMPANY'S STATIONARY ENGINE.

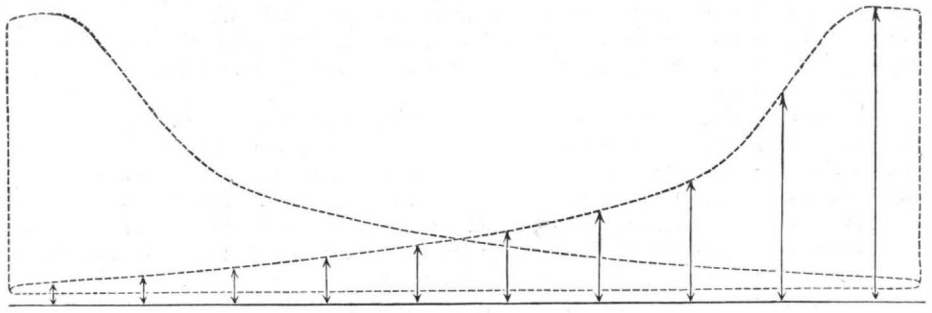
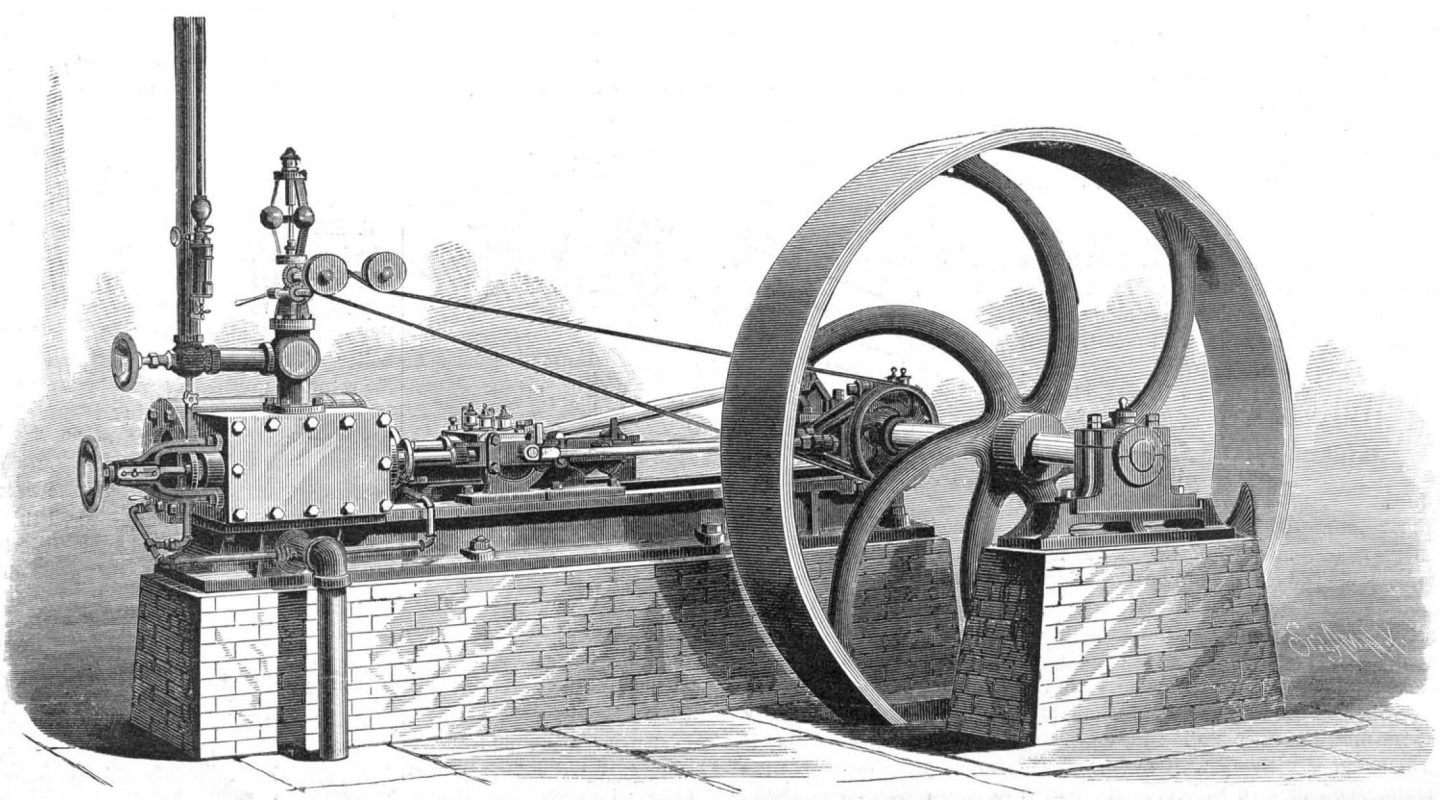


DIAGRAM FROM 14x24 ENGINE.

This card was taken after the engine had run a year, and during that time was handled by three different engineers, showing the performance in the hands of average men, and not a card taken under the very best adjustments of parts and direction of expert engineers.

This engine is driving the flour mill of W. S. Myers & Bro, of Westminster, Md., manufacturing flour known as the new process, running five pair of 42-inch French burrs, two sets of corrugated rolls, and all the other machinery required in a modern mill of that capacity, and requiring about fifty horse power. The actual consumption of fuel was 3,200 lb. bituminous coal in a run of twenty-four hours, grinding one hundred barrels of flour and making a large percentage of middlings. The amount of work is large for an engine of the size named, and the very highest degree of economy could not be expected, but with a greater power of one hundred horse power at least ten per cent better results in economy of fuel can be attained; but from the above results a very high degree of excellence is claimed for the engine as a fuel saver, and its simplicity of construction secures durability and ease of operation

We are informed that this engine is having a large sale in the South in various branches of business, and is becoming very popular. In connection with this class of engine the company manufacture four styles of portable engines, four sizes of improved circular saw-mills, mill machinery, etc. Owing to the great increase of business the company are now erecting extensive shops at Chambersburg, Pa, and will remove their works to that city as soon as shops are completed. For further information address the Taylor Manufacturing Company, Westminster, Md.



25 H. P. STATIONARY ENGINE BUILT BY THE TAYLOR MANUFACTURING COMPANY.

Locusts in Angora.

Last year the village of Angora, in Asia Minor, was devastated by locusts, and, in order to avert a repetition of the calamity which had laid waste several productive agricultural districts, the governor of the province decreed that every able-bodied peasant should, during a certain period preceding the ensuing locust-hatching season, collect locust eggs at the rate of two pounds weight per diem, and deliver them in person to the nearest local authorities. His Excellency fixed the minimum quantity of ova to be gathered in this manner at 1,400,000 lb.

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weight, and furthermore prescribed that a daily fine of two piasters should be levied upon each peasant who should fail to fulfill the duty thus imposed upon him in the general interest of the province. The practical results of this wise and prudent decretal were as follows: During the first day or two of the period appointed for the collection of the ova, a few rustics brought in their quota of eggs, but the large majority of the peasantry, far too indolent to take the trouble of digging them up, compounded with the powers that be by privily purchasing the necessary quantity of eggs from the officials at one piaster per kilogramme, and then making public delivery of the quantity to the employes empowered to receive it. Thus the two or three hundred kilogrammes of eggs really collected and delivered by law-abiding peasants were sold over and over again to the malingerers. These tricksters saved half the amount of their fines, the officials pocketed a piaster by each transaction, and the crop of locusts for the coming season will, in all probability, turn out even finer than that which all but ruined the Angora vilayet last year.—*London Telegraph.*

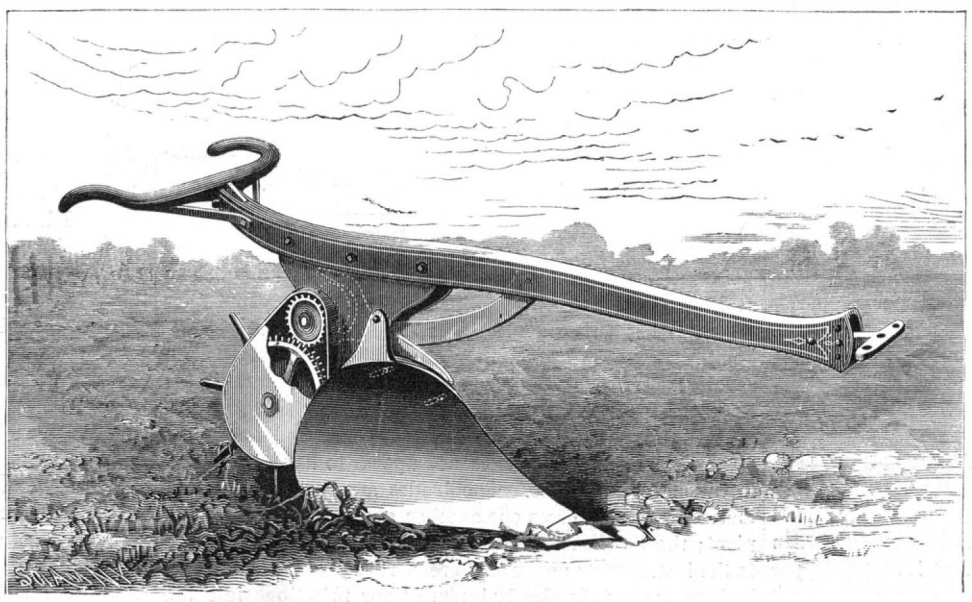
Dyestuffs from Salicylic Acid.

We are not surprised to learn that salicylic acid, now so cheaply prepared from carbolic acid, has been called upon to yield a dye, which will no doubt give a fresh impulse to its manufacture, as hitherto the consumption has been limited to medicinal and antiseptic purposes. A so-called salicylic-acid-yellow can be made from it, which is distinguished by its resistance to weak alkalies, and threatens to replace picric acid, which latter is known to be explosive and easily washed off from the fiber. According to the process employed in Schering's works sulphosalicylic acid is nitrated by treatment with nitric acid, sp. gr. 1·35, for a long time at 40° to 50° C. (100° to 120° Fah.). Or a mixture of sulpho acid and barium nitrate is treated with concentrated sulphuric acid. The nitrosulphosalicylic acid, as well as its salts of the alkalies and alkaline earths, is very solnble in water. The solution dyes silk and wool yellow without any mordant. If the nitric acid acts very energetically on the sulphosalicylic acid the sulpho group will be split off entirely. Bromine can also be introduced into it, forming either a mono or dibromo nitrosalicylic acid, which dyes still more intensely yellow. We should suppose that it would be advantageous to introduce the bromine first directly into the salicylic acid and afterward nitrating with care, since it is said that *hot* nitric acid converts bromosalicylic acid into picric acid.

Sulphosalicylic acid also forms dyes with the phenols; thus resorcine produces a bronze red, strongly fluorescent when in alkaline solution. With diamidobenzole it yields a Bordeaux red, with diazometaxylidine a fuchsine red, and with diazoamidonaphthaline a violet dye. P. N.

IMPROVED PLOW.

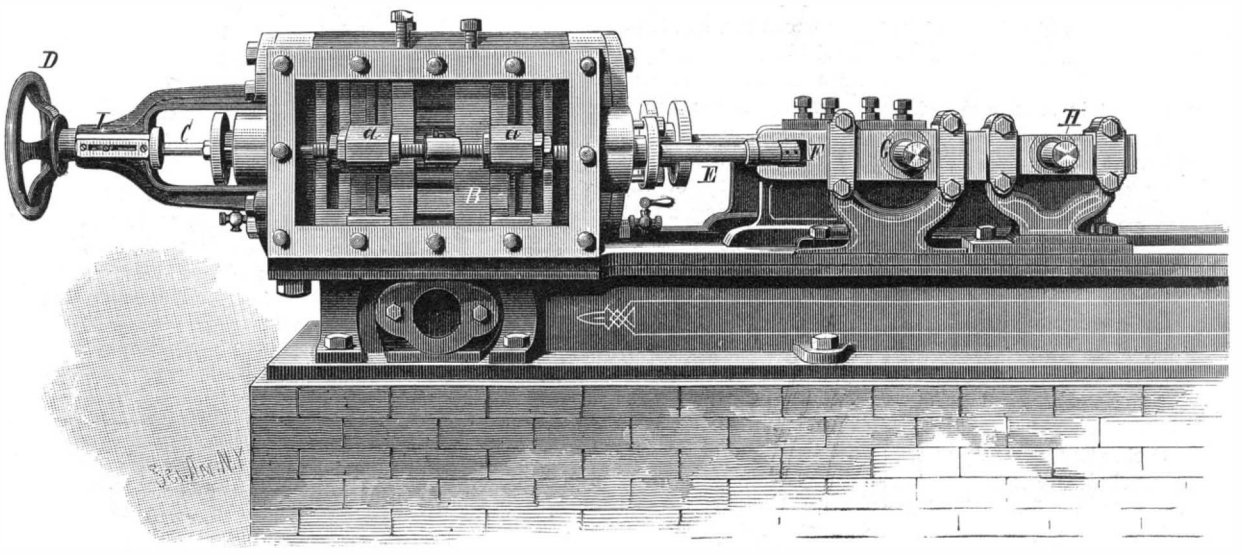
The annexed engraving shows an improved device for preventing plows from choking with weeds and stalks in plowing, patented by Mr. Fernando Gautier, of Pascagoula, Jackson county, Miss. In this device the arrangement of stationary cutters and oscillating cutter is such that when the cutters are ground away by sharpening they may be readily adjusted so as to work as at first. The oscillating cutter is connected with an eccentric at its rear end, the eccentric being operated by the toothed driving wheel through gear wheels, which are inclosed in a suitable case to prevent clogging with soil or weeds. When the plow is drawn forward the drive wheel is revolved, and by means of the gear wheels and the cam, the oscillating cutter is moved vertically, passing the stationary cutters and cutting weeds or stalks that would otherwise choke the plow. The plow beam is made of cast metal, and at its forward end has an enlargement containing a vertically flaring recess, of sufficient depth to receive a short T-shaped clevis, which is pivoted in the bottom of the recess by a bolt, and adjusted in a raised or lowered position by a second bolt, which is passed through one of a series of perforations in the beam and a perforation in the clevis. The clevis is simply a T-shaped bar of iron requiring but little material, and can be more easily made than any other clevis. The handles of the plow are so arranged as to be adjusted to the height of the plowman.



GAUTIER'S IMPROVED PLOW.

Fraudulent Infant Foods.

There are about twenty European preparations styled infant foods, beginning with that of Nestle, and at least twice as many American, all of which profess to furnish a complete nutrition for the infant during the first few months of its existence, while yet the conversion of starch into dextrine and sugar is beyond the capacity of the untrained digestive function. The examination of these with the microscope, assisted by such simple tests as iodine, which turns starch cells blue, and gluten (or albuminous) granules yellow, has engaged the careful attention of Dr. Ephraim Cutter, of Cambridge, and his results will startle most mothers who have relied upon the extravagant pretenses set forth in the circulars of manufacturers.



CUT-OFF MECHANISM OF THE TAYLOR MANUFACTURING COMPANY'S ENGINE.—(See opposite page.)

Eliza McDonough, who preceded Dr. Cutter in this field, has been in a measure discredited; but it appears that her assertion—that the starch, so far from being transformed into dextrine, was not sufficiently altered to render the recognition of its source difficult, whether from wheat, rye, corn, or barley—was strictly true, and that these pretentious foods are, without exception, nearly valueless for dietetic purposes. All of them consist of baked flour mainly, either alone or mixed with sugar, milk, or salts. In some cases, the baking has been very inadequately performed, and the doctor found one that consisted merely of wheat and oats whose starch cells were proximately in their natural condition.

The general result of Dr. Cutter's examination may be stated in brief terms as follows: There was scarcely a single one of the so-called infant foods that contained a quantity of gluten as large as that contained in ordinary wheat flour. That is to say, a well-compounded wheat gruel is superior to any of them, particularly when boiled with a little milk; and mothers are in error who place the slightest dependence upon them. As respects one very expensive article, professing to possess 270 parts in every 1,000 of phosphatic salts in connection with gluten, Dr. Cutter was unable to find any gluten at all. The thing was nearly pure starch, sold at an exorbitant price as a nerve and brain food and a great remedy for rickets. So all through the list. Sometimes a trace of gluten was present; more frequently none at all. In one case there were 90 parts of starch to 10 of gluten; but this was exceptional, and the majority were less valuable, ounce for ounce, than ordinary wheat flour. Considering the semi-philanthropic pretensions that have been put forth by the manufacturers of these foods, some of them sustained by the certificates of eminent physicians, the report of Dr. Cutter is one of the dreariest comments upon human nature that has recently fallen under the notice of the journalist. But if the revelations he has made of fraud and pretense on the part of manufacturers in this field shall serve to protect mothers from further betrayal and to rescue infant life from quack articles of nutriment, his work, though giving a tremendous shock to our sensibilities and to our faith in medical certificates, will not have been done in vain.—*N. Y. Times.*

Copying Drawings.

Tilhet's method of copying drawings in any desired color is thus described in the *Polytechnisches Notizblatt:*

The paper on which the copy is to appear is first dipped in a bath consisting of 30 parts of white soap, 30 parts of alum, 40 parts of English glue, 10 parts of albumen, 2 parts of glacial acetic acid, 10 parts of alcohol of 60°, and 500 parts of water. It is afterward put into a second bath, which contains 50 parts of burnt umber ground in alcohol, 20 parts of lampblack, 10 parts of English glue, and 10 parts of bichromate of potash in 500 parts of water. They are now sensitive to light, and must, therefore, be preserved in the dark. In preparing paper to make the positive print another bath is made just like the first one, except that lampblack is substituted for the burnt umber. To obtain colored positives the black is replaced by some red, blue, or other pigment.

In making the copy the drawing to be copied is put in a photographic printing frame, and the negative paper laid on it, and then exposed in the usual manner. In clear weather an illumination of two minutes will suffice After the exposure the negative is put in water to develop it, and the drawing will appear in white on a dark ground; in other words, it is a negative or reversed picture. The paper is then dried, and a positive made from it by placing it on the glass of a printing frame, and laying the positive paper upon it and exposing as before. After placing the frame in the sun for two minutes the positive is taken out and put in water. The black dissolves off without the necessity of moving back and forth.

Pasteurization of Beer.

In other countries, notably in Germany and America, this system of preserving beer has been extensively adopted, and very favorable results have been obtained. Pasteur's investigations proved that a temperature of 131° Fah. is fatal to diseased ferments, but that yeast cells are capable of withstanding this temperature. In his celebrated work on beer, Pasteur describes the following experiment:

"A number of bottles of beer which had been heated on October 8, 1871, were compared with those of an equal number of bottles of the same beer which had not been heated. The examination took place on July 27, 1872. The beer which had been heated to 131° Fah. was remarkably sound, well flavored, and still in a state of fermentation. As a matter of fact, we have proved by exact experiments that alcoholic ferments, heated in beer, can endure a temperature of 131° Fah. without losing the power of germination; but the action is rendered somewhat more difficult and slower. Diseased ferments, however, existing in the same medium, perish at this temperature, as they do in the case of wine. The beer which had not been heated had undergone changes which had rendered it quite undrinkable; its acidity, due to volatile acids, was higher than that of the other beer in the proportion of five to one; the beer which had been heated contained one-half per cent of alcohol more than the other."

So important a result as is here described ought to be extensively applied; there can be no practical difficulties in the way of pasteurization but such as can be easily surmounted. The first objection that was raised to this process was the risk of the bottles bursting during the process, but this might be easily obviated by firmly fixing the corks in the bottles, and by conducting the process in a vessel so constructed that the pressure on the outside of the bottle is about the same as the internal pressure caused by the expansion of the contents of the bottle by heat. Another objection that has been raised to pasteurization is that it causes the beer so heated to become cloudy, but this is the case only to a very slight degree when the beer is raised very gradually to the requisite temperature; sudden heating will render

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the beer turbid and also endanger the bottles, but by gradually raising the temperature these two drawbacks are greatly obviated. It has also been urged in opposition to pasteurization that the process develops a peculiar and unpleasant flavor in beer, but this objection is not supported by any well-established facts, and we think if the process be conducted gradually no objectionable flavor will be developed. The *Brewers' Guardian* says that this system of preserving beer appears to offer many advantages, and no difficulties but such as enterprise ought easily to surmount, and we are therefore surprised that English brewers have made no real attempt to practically apply it.

Alloys.

From a recent work on "Metal Alloys," published in Germany, the author, Mr. Guetlier, gives a few suggestions on the subject of fusing the metals, with which the *Jewelers' Journal* prefaces the recipes selected.

1. The melting pot should be redhot (a white heat is better), and those metals first placed in it which require the most heat to fuse them.

2. Put the metals in the melting pot in strict order, following exactly the different fusing points from the highest degree of temperature required down to the lowest, in regular sequence, and being especially careful to refrain from adding the next metal until those already in the pot are completely melted.

3. When the metals fused together in the crucible require very different temperatures to melt them a layer of charcoal should be placed upon them, or if there is much tin in the alloy a layer of sand should be used.

4. The molten mass should be vigorously stirred with a stick, and even while pouring it into another vessel the stirring should not be relaxed.

5. Another hint is to use a little old alloy in making new, if there is any on hand, and the concluding word of caution is to make sure that the melting pots are absolutely clean and free from any traces of former operations.

Soft Alloy.—This alloy will adhere so firmly to metallic, glass, and porcelain surfaces that it can be used as a solder, and is invaluable when the articles to be soldered are of such a nature that they cannot bear a high degree of temperature. It consists of finely pulverized copper or copper dust, and is obtained by resolving copper sulphate, or vitriol of copper, into its original elements, by means of metallic zinc. Twenty, 30, or 36 parts of this copper dust, according to the hardness desired, are placed in a cast iron or porcelain-lined mortar, and well mixed with some sulphuric acid having a specific gravity of 1·85. Add to the paste thus formed 70 parts (by weight) of mercury, constantly stirring. When thoroughly mixed the amalgam must be carefully rinsed in warm water to remove the acid, and then laid aside to cool. In ten or twelve hours it will be hard enough to scratch tin. When it is to be used it should be heated to a temperature of 375° C., when it becomes as soft as wax by kneading it in an iron mortar. In this ductile state it can be spread upon any surface, to which, as it cools and hardens, it adheres very tenaciously.

Alloy for Small Articles.—This alloy melts at a lower degree of temperature than the one just described, and is very hard without being brittle. Bismuth 6 parts, zinc 3 parts, and lead 13 parts. The three metals, after having been well melted and stirred together, should be poured into another melting pot and melted again. This alloy cools with remarkably clear-cut edges, and if the articles made of it are dipped in diluted nitric acid, then rinsed in clear water, and polished with a woolen rag, the raised parts of the surface will have a fine polish, while the sunken parts will have a dark-gray, antique appearance, which forms a pretty contrast. The proportions of the different metals, dividing the alloy into 100 parts, are: bismuth 27·27, lead 59·09, zinc 13·64.

Alloy for Small Castings.—Bismuth 6 parts, tin 3 parts, lead 13 parts. This alloy should be melted, run into bars, and laid aside till wanted, when it should be remelted.

Bismuth 3 parts, tin 1 part, lead 1 part. This second alloy for small castings is harder, and yet it is not brittle. It can be finished with a contrasting surface of bright polish and dark-gray, if it is washed in nitric acid, well diluted, rinsed, and polished with a woolen rag, as described in the alloy for small articles, given above.

Hard Solder for Gold.—Gold 18 c. (0·750 fine), silver 10, pure copper 10.

Hard Solder for Silver.—Silver 66 parts, copper 23 parts, zinc 16.

Solder for Platina.—Pure gold, with one-half per cent of platinum and iridium added.

Hard Solder for Aluminum Bronze.—Gold 88·88, silver 4·68, copper 6·44.

Another Hard Solder for Aluminum Bronze.—Gold 54·4, silver 27, copper 18·6.

White Alloy.—This amalgam can be turned, filed, and bored; does not adhere to the mould, and will retain its polish a long time after exposure to the air. Cast iron 10, copper 10, zinc 80.

Solder for Iron and Brass, which Contracts and Expands at the Same Degree of Temperature as the Latter Metal.—Tin 3 parts, copper 39½, zinc 7½.

Solder for German Silver.—German silver 5 parts, tin 4 parts.

Alloys for Medals, Coins, etc.—Kraft's alloy, melting point 104° C. Bismuth 5, lead 2, tin 1.

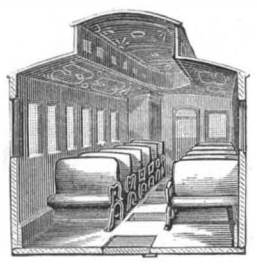
Homberg's alloy, melting point 122° C. Bismuth 3, lead 3, tin 3.

Rose's alloy, melting point 93° C. Bismuth 2, lead 2, tin 2.

Amalgam for Coating Plastic Castings.—Tin 1 part, quicksilver 1 part, bismuth 1 part. The quicksilver is to be mixed with the white of an egg, and added to the tin and bismuth when they are thoroughly melted and blended. The alloy while still hot forms a pasty liquid, which should be applied with a brush.

Safety Car.

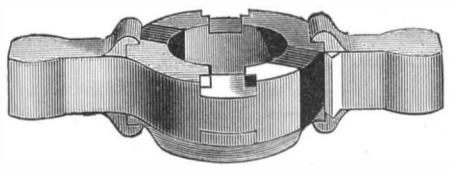
The many lamentable accidents which have occurred by reason of the inability of passengers and others in railroad cars to extricate themselves, or to be rescued, in cases of collisions, derailing, or other accidents, make it highly desirable that better means than are at present afforded should be furnished to meet this difficulty. The ordinary doors and windows of a car are generally blocked, or are otherwise inaccessible. And the object of the invention that is shown in the annexed cut, and is patented by Mr. Alfred A. Starr, of Westfield, Union county, N. J., is to provide an improved means of escape in case of accidents. The invention consists in constructing railroad passenger coaches with trap-doors in their floors within the aisles of the car, and so arranged that they open inward and toward opposite sides. Each of these doors may be nearly the whole width of the aisle, and of any desired length, and when closed are preferably flush on their upper surfaces with the floor of the car, so as to offer no obstruction to walking in the aisle. It is also desirable to hinge them in close proximity to the seats, so that the hinges shall offer no obstruction.



It is proposed to hinge the doors alternately on the opposite sides of the aisle, and it is preferred not to secure them by bolts or fastenings, so that they will be free to open of their own weight, not only when the car is inverted, but also when it falls upon its side. To facilitate the opening of the doors, they are made beveling downward on their opposite sides, and their corresponding seats are made beveling in a reversed direction, so that if violent end pressure is brought to bear upon the car the seats will act as wedges on the sides of the trap-doors to ease and open them. A car thus constructed with trap-doors that are self-opening, or may be conveniently opened either by the passengers in the car or by others from the outside in case of an accident, combines in an eminent degree the elements of safety and simplicity. Should this improvement be adopted by railroads many lives would be saved that are otherwise needlessly sacrificed.

New Millstone Driver.

The engraving shows an improved millstone driver for which a patent was recently issued to Messrs. Callahan and Davis, of 51 Market street, New York city. This is a sectional driver made in two separate arms, having semicircular inner ends. These arms are separated by an intervening cushion of rubber, and are connected together by circular plates provided with lugs which fit into corresponding recesses in the arms.



By this construction a self-adjusting and elastic bearing is provided for both arms of the sectional driver, and all jar and back-lash common to the rigid bearings are avoided. This driver adjusts the stones perfectly and insures uniform grinding, either high or low, and removes a number of difficulties that are met with in the use of the ordinary driver.

Pompeian Surgery.

An interesting sketch of the surgical instruments collected at Pompeii, and preserved in the museum at Naples, has been given in a recent number of the *Revue Médicale* by M. Jouin. At the museum they are arbitrarily divided into surgical and obstetrical instruments, but there is little in the latter to suggest that they were intended for obstetrical purposes. A pair of forceps, for instance, classed among the obstetrical instruments, does not appear to have been ever intended for such use. The blades are twenty-one centimeters long, they cross one another, and are articulated by a pivot; the handles are curved; they are apparently similar to the instruments now used to remove sequestra, etc. There is, however, a tube clearly intended for injections into the vagina. It is twelve centimeters long; one extremity is manifestly designed to receive the nozzle of a syringe, while the other is perforated with holes, one terminal and the others arranged in two circles, so that the jet may be broken and spread, just as in the similar tubes in use at the present day. There is also a very ingenious trivalve speculum, evidently intended for the vagina, so made that the three blades can be opened or closed simultaneously. There is a rectal speculum, fifteen centimeters long, composed of two blades which can be closed or opened by means of a pivot placed in the center of the instrument, and presenting the type according to which all similar specula are made at the present day.

There are catheters for women, straight, made of silver. A curious instrument, which consists of an iron rod, at the extremity of which is a small rectangular plate of iron, two centimeters long and three wide, fixed to the rod at an angle of 135 degrees, is exhibited as a cautery for wounds, the Italian surgeons believing that it is intended to cauterize deep structures, such as the uterus or pharynx. The perfect resemblance in form to the laryngeal mirrors now in use suggested to M. Jouin that it may really have been intended for a similar use, to examine deep structures, if not the larynx. Catheters for men have also been found; they are twenty-seven centimeters long, and have a very peculiar double curve like a very long S. M. Jouin thinks that this form shows a very imperfect knowledge of the real curves of the urethra; but under ordinary circumstances this is nearly the form of the urethral canal, and although the introduction of such an instrument may have been a matter of some difficulty, its shape would facilitate the emptying of the bladder.

Among the other instruments are a metallic trocar in two pieces, similar to those in use at the present day, bistouries, very large lancets, various forms of stylets, curved and straight, some probably intended for the examination of carious teeth, curette spatulas, small forceps, and various needles and hooks. There are also some surgical cases with instruments, and cases for pills, ointments, etc. All these instruments were found in one house, and in number they will certainly bear comparison with those possessed by an average practitioner in a provincial town at the present day. —*Lancet.*

Electric Photo Shutter.

At a recent meeting of the South London Photographic Society, Mr. G. F. Williams exhibited an instantaneous shutter with an electrical liberating attachment, being an efficient trigger, which can be applied to almost any known kind of shutter or exposing valve. It can be converted into either a horizontal or rising shutter by the mere addition of an elastic spring, with a suitable catch or clutch to retain the moving part of the shutter at the end of its travel.

Mr. Williams has improved upon the clever arrangement of Gaiffe, of Paris—who patented the chloride of silver battery—by cramming two elements into one cell. As is known among electricians, this battery depends for its energy upon the reduction to the metallic state of chloride of silver by the passage of the electric current. A small plate of zinc, no larger than the little finger, has a piece of millboard placed upon it; then chloride of silver is melted in a porcelain crucible, and poured into a mould, which may be made of wood—thus casting a plate of similar size to the zinc. This plate of fused silver chloride is wrapped up in muslin and placed so that the millboard separates it from the zinc. A silver wire or thin plate of silver, laid on the plate of fused chloride, completes the "element;" but, as before stated, Mr. Williams has placed two such elements within an ebonite cell of about two ounces capacity. When so arranged the composite battery is dipped into a saturated solution of sal ammoniac and the excess allowed to drain off. No fluid is used in this battery—the elements are merely kept moist. A suitable touch-button and conducting cord completes the arrangement. The shutter being set "full cock," a touch on the button sets the electric current free; this circulates the wire of the electro-magnet, the keeper is attracted, the detent removed, the shutter moves, and the exposure is made.

Fast Railroad Lines.

The innovation of the Pennsylvania Railway in its fast trains between New York and Chicago suggests comparisons with lines abroad. The famous Flying Dutchman on the Great Western Railroad, England, makes the run from London to Exeter, 194 miles, in four hours and fourteen minutes. With four stops it attains a speed of almost 46 miles an hour. A train on the Great Northern Road makes the distance from London to Leeds, 187 miles, in four hours—almost 47 miles an hour, with four stops. The train carrying the Irish mail to Holyhead, over the London and Northwestern line, and dubbed "The Wild Irishman," has now sunk into comparative obscurity with its rate of a little less than 40 miles an hour. The morning express on the Great Northern Road makes only four stops along the line from London to Edinburgh, 395 miles, and flies over the whole distance in nine hours, with an average rate of 44 miles an hour; and on the Midland line the night Scotch express runs the 425 miles to Glasgow with a speed of 40½ miles an hour. These are the four swiftest trains in England, and, as will be seen, the Leeds express, with its rate of 47 miles an hour, is the fleetest of them all. Three out of the four trains probably beat the running time for the same distance on any other roads in the world. They are all, however, far outstripped for a shorter distance by the train on the Pennsylvania Railroad, which leaves Jersey City at 4:10 P.M., and makes the run of about 88 miles to Philadelphia in 100 minutes, with one stop, at Trenton. The 52·8 miles an hour made by this American train is probably without parallel in the schedule time of any railroad company on the globe. On both the American and English railroads it must also be remembered that for short stretches of straight track, with good road bed and favoring grades, a speed of 60 miles an hour is not very uncommon.—*Nat. Car Builder.*

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The Acorn-Storing Woodpecker.

BY ROBERT E. C. STEARNS.

The acorn-storing habit of the Californian woodpecker (*Melanerpes formicivorus*) has long been known to the "country folk" and others who frequent the country and take notes by the way. Before the American occupation, the Spanish Californians had observed this curious habit, and gave the bird the appropriate and musical name, *"el carpintero."* No doubt, still further back the aborigines had their name for the *carpintero*, and regarded the bird as invested with superior power, or possessed by some unseen or hidden influence, which placed it above its feathered congeners and proved it to be in some mysterious way a little closer to the heart of nature.

It is highly probable that if we knew the traditions of the former red men of California, we should find some quaint story or curious legend connected with this ingenious and interesting bird. I find no mention of this woodpecker in either Bancroft's * or Powers' † ethnological volumes, relating to the California tribes.

During a recent visit to Napa county, I noticed near the house where I stayed, on Howell Mountain, a fallen pine of the species known to botanists as *Pinus ponderosa*, the yellow pine of the woodsmen, the bark of which was full of acorn holes.

The tree was a noble specimen, and its prostrate position gave me a chance to learn not only its dimensions, but also to ascertain very nearly the number of holes which the woodpeckers had made in its bark.

In falling, the tip of the tree had broken off, and was so hidden in the general *debris* of fragments of branches, cones, and underbrush, as to escape detection. The length was not less than 175 feet, the diameter of the butt just above the ground, five feet ten inches. At ninety feet the diameter was three feet eight inches. Above the ninety foot line the holes continued, but were so scattering that they are not included in the reckoning. Neither are those in the first ten feet of the trunk, as between the ten foot line and the ground they were comparatively few.

Between the ten foot line and the ninety foot line the number of holes to the square foot, with a fair allowance for verification, was from *sixty* to *twelve*. A piece of the bark, sawed from the tree by my own hands, which measures exactly twelve inches by twelve inches, contains sixty holes; this is a much smaller number than could be counted in the same sized piece in a great part of the section of eighty feet, while twelve is a very low minimum.

The two diameters as above given when added make eight feet and eighteen inches, the average diameter being one-half of this, or about four feet nine inches; this multiplied by three, to get the circumference, gives fourteen feet and three inches; and this again multiplied by the length of the section, eighty feet, produces 1,140 square feet.

Now, if we add the maximum and minimum of acorn holes to the square foot (sixty and twelve), we have seventy-two, which divided by two, gives an average of thirty-six to the square foot, and thirty-six times 1,140 gives a product of forty-one thousand and forty (41,040) acorn holes.

The holes are of different sizes, varying with the size of the acorn which each hole is made to receive, for these birds are good workmen, and each acorn is nicely fitted into its special cavity. Making a fair selection of acorns as to size, I find that it takes on an average seven to make an ounce (that is, picked when green); and taking that number for a divisor, it shows the total weight of acorns required to fill the holes in the tree is three hundred and sixty-six pounds seven ounces, avoirdupois. Whether any particular species of acorn is preferred, I am unable to say. The acorns in the tree above described, so far as it was possible to determine them without the cups, which the woodpeckers reject, appeared to belong to the nearest adjacent oaks, *Quercus chrysolepis*. This oak is very abundant all around the mountain, and is itself peculiar in having two forms of leaf on the same twig.

At the upper end of Pope Valley, not far beyond Ætna Springs, I noticed a standing pine of the same species as that described and of about the same dimensions as the foregoing, which was full of holes. In Knight's Valley, in August, 1879, I observed woodpecker holes closely set in the bark of a large Douglass spruce (*Tsuga douglassii*); and I have been informed by various parties that these woodpeckers also bore and deposit acorns in the bark of various species of oaks.

Sometimes the acorn holes are made in the *wood*, as I have been informed by a friend, Mr. C. H. Dwinelle, of the University of California, who has seen such holes in a species of white oak in Alexander Valley. He also related an instance of the "carpintero" sticking acorns in a crack between the boards in the porch of a house in Redwood City, San Mateo county.

Mr. J. W. Bice, of the University, has also observed acorns stored in the white oaks near Healdsburg, in Sonoma county, as well as in the cracks between the boards in and round the projecting eaves of barns and houses. Where the projecting rafters are boxed in, sometimes they will find a hole, and at other times make one, and store acorns in large quantities in such places.

In clearing land the trees are girdled, and in about two years the bark drops off, leaving the exposed wood of the trunk in a sappy state, particularly on the side which is usually in the shade, and this side is especially selected by the woodpeckers for their purposes. They not infrequently drop acorns down chimneys, where of course the result of their labor is without any advantage.

Upon turning to the volume on Ornithology in the Geological Survey of (California) publications, in reference to this species of woodpecker, it says: "They are fond of playing together around the branches, uttering their rattling calls, and often darting off to take a short sail in the air, returning to the same spot. They have a habit, peculiar to them, of drilling small holes in the bark of trees, and fitting acorns tightly into them, each one being carefully adapted and driven tight. The bark is often so full of these as to scarcely leave room to crowd in another without destroying the bark entirely. These are generally considered as laid up for a winter supply of food; but while in this climate no such provision is necessary, it is also very improbable that birds of this family would feed on hard nuts or seeds of any kind. The more probable explanation is that they are preserved for the sake of the grubs they contain so frequently, which, being very small when the acorn falls, grow until they eat the whole interior, when they are a welcome delicacy for the bird. Whether they select only those containing grubs, or put away all they meet with, is uncertain; but as they leave great numbers in the tree untouched, it is probable that these are sound acorns, and often become a supply to the squirrels and the jays."

Without questioning the foregoing as to the preference of the woodpecker for animal food, and especially for the larvæ often contained in the acorns, it is undeniable that in common with the jays, they are exceedingly fond of fruit, as many an orchardist can testify; and their predilection for almonds *before these nuts are quite ripe*, is well known to the cost of many almond growers; that they eat other nuts and also acorns to some extent, I have no doubt. The jays and squirrels are quite likely benefited by the acorn-storing habit of this species of woodpecker; and I have been told that the jay sometimes assists the woodpecker by bringing acorns for the carpintero to deposit in the bark; and further that sometimes the jays put pebbles in the acorn holes "to fool the woodpeckers;" but these latter statements, though perhaps true, need confirmation.

As several woodpeckers are engaged in the work at the same time on the same tree, their operations, as may be imagined, are carried on with a good deal of vivacity and noise, in which the jays become interested, and dart about, adding to the tumult in their own peculiar chattering way.

The latter have related singularities in the matter of food-storing, as will be seen below. The friend, Mr. Dwinelle, whom I have already quoted, states that the large thistle, which is abundant in certain places in Alameda county, owes its distribution in part to the jays, who take the seeds, which are of good size, and plant them in the ground. He further states that a friend of his, who fed Indian corn to his chickens, had observed the jays fly down and pick up a kernel and then go off a short distance and plant it; in this way he discovered how it was that stalks of maize came up and were growing where he had never planted.

Mr. Dwinelle has himself seen a jay plant an acorn in the ground of his (Mr. D.'s) house-yard or garden in Oakland. The bird deliberately made a hole, thrust in the acorn, covered it, and then put a chip on the spot, perhaps the latter as a mulch; then flew away, found another acorn, which it accidentally dropped in a growth of periwinkle (myrtle), and after searching for it without finding it, gave up and flew away.

As it is hardly presumable that the jays plant either the corn or the thistle for the purpose of perpetuating those species of plants with the object of obtaining food from future crops, it is likely that being full fed at the time, with appetites satisfied, they simply buried the seed for future need, as a dog buries a bone, and forgot all about it, or not needing the same, the seeds remained where the birds planted them, until they germinated and grew into plants.

The holes made by the woodpeckers in the bark of trees also serve as a lurking place for beetles, ants, and other insects, so that both vegetable and animal food are brought together side by side to furnish a meal in time of need, in which perhaps the jays sometimes participate. Judging by the tree herein described, it would seem as if there were enough for all.

Mr. Bice is of the opinion that the acorns are stored simply for the larvæ, which the *carpintero* eats after the maggot has attained a good size. He also relates the following, which is worthy of note: "On cutting down a hollow oak on his father's place, a woodpecker's nest was discovered after the tree had fallen, and a young bird of the *carpintero* species was found and caught, being unable to fly. It was carefully reared, and became a great pet with the family. After it had reached maturity and was perfectly able to fly, though no restraint was placed upon it, it would come at once in answer to call, leaving its fellows in the trees. Upon one occasion, when the family went several miles from home to visit a friend, the bird followed them, though at the time they were not aware of it, and only learned the fact from the friend whom they had visited, and who caught and kept the bird until an opportunity offered for returning it. Probably if it had not been caught it would have followed the family back."

There is a larger species of woodpecker, with plumage much resembling that of *M. formicivorus*, which sometimes appears in flocks, and helps itself, or tries to do so, to the stores laid up by *el carpintero*, who bravely fights the marauder. I have been unable to learn to what species these depredators belong.—*American Naturalist.*

* "Native Races of the Pacific States."

† "Contributions to Ethnology," U. S. Geog. and Geol. Survey, Powell, vol. iii., 4to.

Dubrunfaut on the Manufacture of Starch-Sugar.

In 1823 Dubrunfaut, whose death occurred last year, laid before the Society of Agriculture in Paris a memorial on the "Saccharification of Starch." In 1825 his celebrated work entitled "Art de fabriquer le sucre de betteraves," appeared. Afterward he discovered osmose, and also an "elegant" method of separating the two constituents of inverted sugar, viz., glucose (maltose, grape, and starch sugar), from lævulose (fruit sugar). A few days before his death, which was caused by the inhalation of illuminating gas, he published the following article:

The success that has attended the technical preparation of crystallized or "block" maltose, as well as the crystal sirup that can be made from it, leaves no doubt of the existence of very decisive results of the laboratory experiments, as well as improvements to be effected on a larger scale for brewers and distillers. It must be confessed that, for very important reasons, we have not been able to carry out these improvements smoothly in practice.

The question is of great interest to our own (the European) sugar makers, because the manufacture of maltose is called to be at once the helpful sister, and perhaps the rival of this industry.

Maltose correctly prepared by our method is perfectly *free* from the impurities which are found in commercial glucose, and the crystal sirups made from it have the properties of refined sugar and its derivatives as a pure substance for sweetening or fermentation. In this respect there can be no doubt that this new sugar, which like starch sugar, for instance, is less severely taxed by the government, can advantageously replace the crystallizable sugar for many industrial purposes, especially for sweetening wine.

These uses unavoidably infringe upon the domain of the wonderful products of the sugar beet (that don't apply in this country—ED.), but it must be remembered that the manufacture of glucose is destined to invade the sugar-boiling establishments themselves, because it makes it possible to keep the whole of the auxiliary apparatus going during the entire year. Then, too, if we recollect that the foundation of this sugar, its raw materials, are *agricultural* products, which, when used in this way, leave nutritious residues, it will be easy to see that the new maltose industry is really an *element* of progress for the interests engaged in the manufacture of sugar comparable with those which would arise from a new use of crystallizable sugar.

Although in our domestic factories the maltose industry would naturally take its place at the close of the sugar campaign, we do not need to postpone our project of introducing this industry until the end of the season, and if, as we do not doubt, our other new process of "making sugar without molasses" ends with the year, the campaign will end in January. Then those factories that use our "no molasses process" will be able to introduce the new maltose manufacture as early as January too.

The editor of the *Chemiker Zeitung*, from which we take the above, expresses the opinion that the distillers who are already converting sugar into starch by *rational* methods, would be better able to undertake the manufacture of maltose than the beet sugar factories referred to by Dubrunfaut.

Effects of Heat on Electrical Conduction.

Prof. F. Guthrie, F.R.S., recently read a paper on the discharge of electricity by heat. He showed by means of a gold leaf electroscope that a red hot iron ball, when highly heated, would neither discharge the positive prime conductor of a glass electrical machine nor the negative one, but on cooling the ball a temperature was found at which the ball discharged the negative conductor, but not the positive one. Lastly, on cooling the ball still further—but not below a glowing temperature—it was found to discharge both positive and negative electricity. A platinum wire rendered red hot by the current also discharged a negatively-charged electroscope more readily than a positively-charged one. When placed between two electroscopes, one having a + and the other a — charge, it discharges neither. When the + one was withdrawn the — was discharged, but when the — was withdrawn the + was not discharged. There therefore seemed a tendency in a hot body to throw out + rather than — electricity. These are interesting experiments, and open a little room for discussion *versus* positive and negative electricity.

Magnetic Properties of Steel and Iron.

MANY investigations upon the relation between the molecular conditions of iron and steel produced by heat, by torsion, and by annealing processes, and the resulting changes in magnetic conditions, have been made. It appears from the paper of Louis M. Cheesman that the effect of mechanical hardening has not been properly investigated, and this paper contains the results of his investigation upon this point. The method of research consisted simply in determining the magnetic moment of the magnetic bar after it had been subjected to well devised mechanical pressures. The result of his investigations is summed up as follows: Iron in a mechanically hard condition can receive more permanent magnetism than in a soft condition. The magnetic moment of a steel magnet in a mechanically hard condition is greater or smaller than in a soft condition, according as the ratio of its diameter to its length is less or greater than a certain limit.—*Ann. der Physik und Chemie.*

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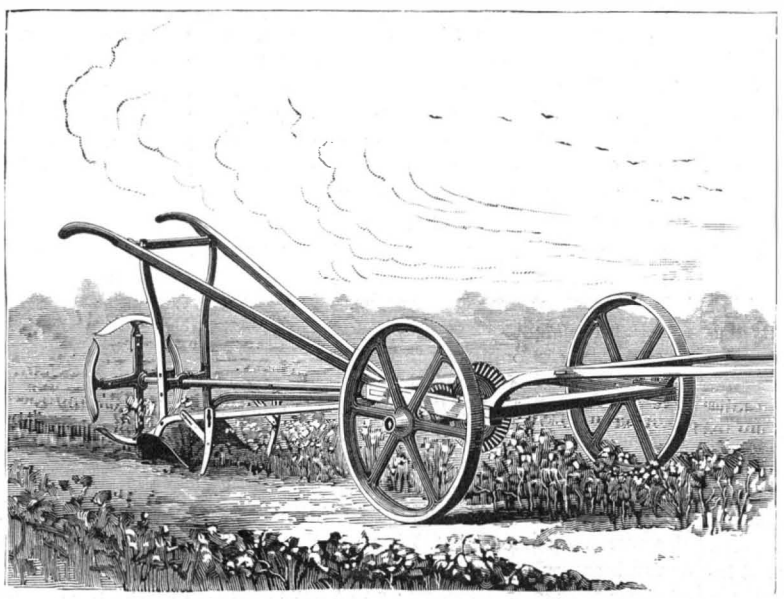
NEW COTTON CHOPPER.

The engraving shows a cotton chopper having a carriage with gear wheels connected with its rotary axle and driving two shafts connected endwise by a universal joint. Radial arms attached to the rear shaft carry the chopping knives, which revolve at the rear of two plows provided with adjustable colters for barring off the rows. An upright frame is connected with the carriage frame and provided with handles, and a swiveled bearing for connecting the plow beams and handles with the shaft, so that the chopper can be readily guided and controlled.

The radial arms carrying the chopper knives are slotted to admit of adjusting the knives so that they may work at any desired depth in the ground, and to leave more or less of the plants standing, as the adjustment to and from the center opens and closes the distance between the knives.

The knives are set at an inclination with the plane of the chopper wheel, and their entering ends are sharpened so that there will be space between the rear end of each knife and the point of the one following to leave enough plants for a hill.

This implement is easily managed, very simple in its construction, and is well adapted to its purpose. It was recently patented by Mr. Josiah L. Hughes, of Cleveland, Tenn.



HUGHES' COTTON CHOPPER.

Action of Telephonic Currents upon the Galvanometer.

If in a telephonic circuit we substitute for the receiver a very sensitive galvanometer, and if we act upon the transmitter by means of a tuning fork, an organ pipe, or the voice, we observe no deviation as long as the sound preserves the same intensity, but as soon as it increases or diminishes the needle deviates. This movement changes its direction according as the amplitude of the vibrations of the sounding body increases or decreases. The effect is most marked when the transmitter is affected by a sound of short duration, such as a detonation or by a body struck slightly upon the vibrating plate. In the latter case, the needle of the galvonometer leaps like the second hand of a clock. The experiment succeeds well if the sounding body is approached to or withdrawn from the transmitter. These deviations appear much more distinctly when a microphone transmitter is used, such as that of Ader, but they are visible with every kind of telephone.

The explanation appears simple. As long as the oscillations of the vibrating plate retain the same amplitude, and consequently the same speed, the induced currents at each complete vibration compensate their action upon the galvanometer alternately in both directions, whether they proceed from an electromagnet or from a microphone. But if the oscillations tend, *e. g.*, toward zero, each odd semi-oscillation has a greater amplitude than the even semi-oscillation following, and the induced currents, direct and inverse, no longer set in motion, two and two, the same quantity of electricity. The residues of the same direction in each complete oscillation accumulate so as to deflect the needle, and the deflection is the greater as the decrease is the more rapid.—*M. de Chardonnet; in Comptes Rendus.*

Photo-Zinc and Platinum Process.

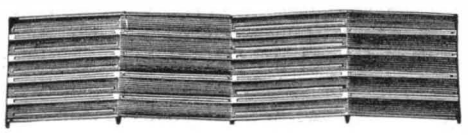
Captain Biny proposes to treat with dilute platinum bichloride a polished zinc plate on which a negative image, with all the half tones (taken from a positive), has been impressed by means of coal tar. He finds that a kind of daguerreotype of great delicacy is produced on the zinc, and with exquisite modeling. These prints will be cheaper than the daguerreotypes produced by the deposit of mercury on silver plates. So far as I know—and it will be easy to verify the statement by experiment—the black oxide of platinum is deposited to a greater or less degree on all the parts of the zinc plate that are denuded; the half tones of the image formed by the coal-tar will be the resist, and the deposit will be proportional to their intensity. In other words, we shall have an image which, owing to the black color of the oxide of platinum, will be in harmonious contrast with the bright tint of the metallic zinc, and which will be perfectly modeled.

NEW DISINTEGRATING RIFFLES.

Notwithstanding all the modern improvements in mining machinery, immense quantities of precious metals are constantly washed away and irrecoverably lost. The value of this lost portion, according to various estimates, is very nearly if not quite as great as that of the metal secured. A great deal of engineering skill and inventive genius have been employed in trying to devise means of preventing this great loss. This has generally resulted in placing various devices in the sluices to catch and retain the stray particles of metal or sulphuret. Some of these inventions have been more or less successful, but none of them have saved anything like a reasonable proportion of the valuable part of the tailings.

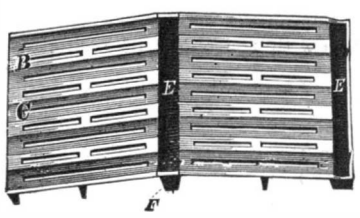
Our engravings represent a new form of riffle, which has been in use in quartz and hydraulic mining for over three years, and has proved itself effective in saving the largest possible percentage of the precious metal.

This riffle imparts to the water almost every conceivable movement, producing under currents, cross currents, eddies, etc., and the peculiar form of the riffle sections insures the pulverizing of any lumps that, in hydraulic mining, may be carried along by the current, and induces the precipitation of the particles of gold and sulphurets. It is claimed that this riffle, wherever used, has demonstrated that, as a concentrator of all classes of ores, it has thoroughly proved its superiority.



No. 2 MILL RIFFLE WITHOUT CUPS.

The simplicity, durability, and inexpensiveness of these riffles must commend them to universal use, and the increasing demand, together with the strong testimonials and unqualified indorsement of those now using them, serves to show that they are destined to supply a want heretofore unsatisfied in the direction of close working of mineral ores.



A RIFFLE SECTION.

We are informed that it is immaterial what amount of water is used in their operation, so long as the quantity is sufficient to move the pulverized material as it comes from the mill or pan, and also that they prevent the loss of all quicksilver that escapes from the mill or amalgamator, a most important feature, considering the amount that so escapes, and that by any other process fails to be secured.

Another point in their favor is that they can be removed in sections while securing their accumulations, thus avoiding the necessity of an entire stoppage of work.

Although the illustrations show the form and arrangement of the riffle sections, we give the following brief description:

A is a section of mining flume, or sluice, through which auriferous material is carried by a stream of water. On the bottom of this sluice the riffle sections are placed, covering the bottom of the floor, in longitudinal rows, with ends joining each other. The sections in one row overlap or break joints with the sections of the adjoining row. The incline on each side of the apex of each section is provided with a number of parallel slots, B, extending its entire length. The portion, C, of metal between each pair of slots is hollowed out on its upper surface, forming channels. In the transverse shallow box, E, at the bottom of each incline, quicksilver may be used.

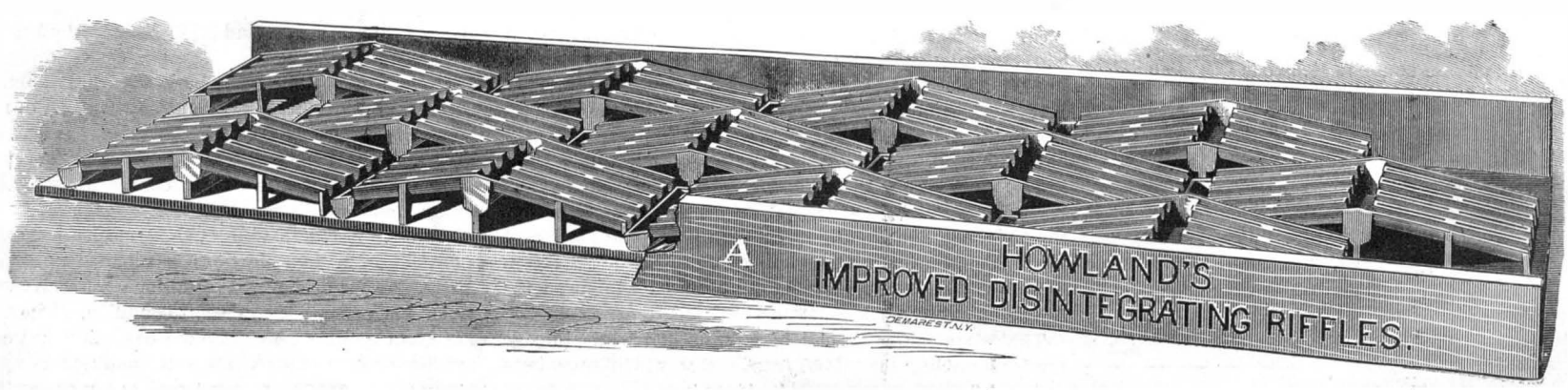
A vertical partition, F, extends downward from the under side of the ridge or apex to the floor of the flume, forming a riffle or obstruction for arresting the heavy particles. The material passing through the slots into the chamber underneath the section is arrested by the partition, F, and an eddy is formed in which the heavy particles settle, while the water and lighter material pass on through the open sides of the chamber diagonally across upon the first incline of the following section in the adjoining row, where the operation is repeated. The current is thus broken and separated, and directed from one section to the other, and from one row of sections to the other row, throughout the entire length of the floor of the sluice. The effect of alternating the sections in the adjoining row is to produce cross currents, which prevents the sand and clay from packing, and washes the sulphurets and heavy particles, thus keeping them in clean condition.

For further particulars address the New York Mining Machinery Company, 39 Broadway, New York.

Diphtheria.

Dr. Franklin Staples, of Winona, Minn., after an extended correspondence with physicians in most of the counties of his State, has published a report on diphtheria, in which he classes the disease as contagious and infectious, and demonstrates that it is on the increase—a fact due, in his opinion, to failure on the part of physicians in recognizing its self-propagating properties; to want of systematic nursing of patients suffering from the disease; to incomplete disinfection of premises attacked; and last but not least, to the frequent intercourse of convalescents with healthy persons. He maintains that strict regulations, rigidly enforced, are the only means adequate to cut short its career, and since individual power is unable to cope with it, urges that every city and town should devise efficient sanitary laws, and let them be enforced by intelligent medical officers, who shall also make it their duty to instruct the people in sanitary rules. To guard against contamination, he believes that filth, whether from dirty rooms, soiled clothing, defective drains and cesspools, ill-ventilated rooms, poisonous inodorous gases, etc., should be regarded as conditions which invite the disease; that the apartments set apart for the patient should be divested of all furniture, carpets, curtains, and fabrics of any kind not absolutely required; that discharges from the nose, mouth, and bowels should be carefully collected and destroyed, and that all personal clothing, bed linen, etc., should be thoroughly disinfected before being sent to the general wash. In case of death, all clothing and unimportant articles should be burnt, the body should be immediately disinfected and put into its coffin, which should be kept permanently closed. There should be no public funeral. He prefers disinfection by chlorine gas, which is to be set free in the room. Ventilation for a number of hours should then be insisted upon. Precautions falling short of these Dr. Staples considers to be useless in preventing the spread of the infection.—*Report on Diphtheria to the Minnesota Board of Health*, 1881.

PATENTS IN GERMANY.—Last year there were 7,177 applications for patents in Germany; 4,339 were granted. This is the largest number granted in any year save one, 1879, when the number of patents issued was 4,410.



HOWLAND'S DISINTEGRATING RIFFLES.

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THE GREAT ANT-EATER AND ITS YOUNG.

BY C. F. HOLDER.

The ant-eaters (*Myrmecophagidæ*) form one of the most interesting families known to science, and comprise a number of forms that, as their name indicates, gain a living by assaults upon the nests of ants found in the countries to which they are indigenous. The largest and best known of the family is the great ant-eater, or ant-bear, which is covered with long, coarse, shaggy hair, except the head, where it is short and close; it has a very long and slender head, and a bushy black tail of enormous size and length, the whole animal measuring often eight feet from the tip of the snout to the extremity of the tail. Being plantigrade, it stands lower on the hind legs than before, which is the case with bears and other quadrupeds similarly formed. It has four toes on the fore feet, the second and third being provided with long, sharp-pointed, and trenchant claws; so that nothing upon which it has an opportunity of fastening can escape. The hind feet have five toes, furnished with short weak claws, resembling those of ordinary quadrupeds. In the fore limbs we notice that the ultimate phalanges of the toes, which support the claws, are so constructed as to allow the movements of the latter being restricted to flexion inwards; and in order to maintain this position there are powerful ligaments which keep the phalanges directed toward the palm, and never allow the digits to be stretched out in the manner of the plantigrade carnivora. The relative size and strength of the toes are also very significant in this family; in those which have five toes the central digit attains an enormous bulk, while the outer pair are comparatively very small. And, in order to afford adequate power for the digging and burrowing propensities of these animals, the phalanges are all closely connected together up to the base of the ultimate phalanx, converting the hand into a kind of trowel, similar to that found in moles.

From what has been advanced, it will readily be remarked that ant-eaters do not walk on the soles of their feet; neither do they tread on their strongly-curved toes, which would damage the claws, but, in the fore feet at least—as may be seen by referring to the engraving—the anterior part of the body is seen to rest entirely upon their outer edge; and that part of the hands thus subjected, as it were, to an unusual pressure, is, in these creatures, supplied with an efficient callous pad to protect the outer phalanges from injury.

The prevailing color is a deep gray, with a very broad band of black running from the neck downward on each side of the body; its habits are slothful and solitary; and it sleeps during the greater part of the day. It lives entirely upon ants, to procure which it opens their hills with its powerful crooked claws, and draws its long flexible tongue, which is covered with glutinous saliva, lightly over the swarms of insects who flock from all quarters to defend their dwellings. It is a native of Brazil and Guiana.

It seems almost incredible that so robust and powerful an animal can procure sufficient sustenance from ants alone; but this is nothing strange to those who are acquainted with the tropical parts of America, and who have seen the immense quantities of these insects, which swarm in all parts of the country to that degree that their hills often almost touch one another for miles together. The favorite resort for the great ant-eaters is the low swampy savannas, along the banks of rivers, and stagnant pools.

The enormous claws of the forelegs are terrible weapons. Waterton records an instance of their power in his "Wanderings," and in Brown's "Canoe Life in Guiana" there is a similar account. He says: "We had not gone many miles before the guide lost the path, and we all scattered to look for it. In doing so, I almost walked on the top of a sleeping ant-bear, which, springing up, sat on its hind legs, and grasped at me with its huge fore claws. I sprang quickly to one side, and thus escaped. Thinking that it was good eating, I shot it, but the Indian said that it was not wholesome food, although, from the great interest they took in seeing it killed, I thought it was." (Waterton says that its flesh is good eating.)

These large ant-eaters are very dangerous customers, and have been known to kill men. Williams told me that an Indian, living near Roraima, was hunting in the forest to the north of that mountain with some others, armed with his long blow-pipe. In returning home, considerably in advance of the rest of the party, it is supposed that he saw a young ant-eater, and, taking it up in his arms, was carrying it home, when its mother gave chase, overtook, and killed him; for, when his companions came up, they found him lying dead on his face in the embrace of the ant-bear, one of its large claws having entered his heart. In the struggle he had managed to stick his knife behind his back into the animal, which bled to death, but not before the poor fellow had succumbed to its terrible hug. It was evident that he had only heard the ant-eater coming when it was close upon him, and in turning round to look, his blow-pipe got caught across the path in front of him; then, as he turned to run, it formed a bar to his progress, and he fell over it as the animal seized him. So firmly had the animal grappled him that to separate it from the corpse the Indians had to cut off its fore legs.

THE GREAT ANT-EATER AND ITS YOUNG.

It is very rarely that an opportunity offers to observe in this country the habits of one of these curious creatures, but recently an ant-bear was brought here alive from South America, and on the passage gave birth to two young, which the writer afterward saw, and watched with great interest their movements about the mother. The poor creature fared badly on the voyage to the United States, as the sailors were ignorant of the nature of the animal, and its curious appearance impressed them with such a feeling of aversion that no one could be found to approach the family of compulsory immigrants, and they were only kept alive by the boiled eggs that were tossed them by some of the more humane of the crew. The little ones, as we saw them, were about a month or six weeks old, and were perfect images of the mother, with the exception that the tail was not so large in proportion to the body, and the curious color markings were not so pronounced as in the adult. As we approached the cage, nothing could be seen but a bunch of coarse grizzly hair; but a word from the owner, and the enormous tail of the parent was raised, and the young were seen. She was lying on her side, the young embracing her abdomen, after the fashion of young monkeys, and over all came the tail of the mother, shutting and inclosing them like a lid, forming effective protection. As she clumsily rose the young scrambled over and attained a position on her back, clinging to her with their long claws, their bushy tails in air, lost in the voluminous folds of the mother's, that covered them even now as a canopy, being equally protective.

At a word from the keeper, she came laboriously toward us, walking upon the outside of her sharply clawed feet, and the long noses of the entire family were presented and rubbed against our hands with every demonstration of friendliness.

The tongue is extremely long, and below its roots are two large glands that emit a glutinous secretion that is so effective in conveying the swarms of ants to its mouth. They were fed exclusively upon hard boiled eggs, upon which we were informed they thrived. The climate, however, is against them, and since our first visit one of the young has died, and the other will probably follow.

In the accompanying illustration the position of the young on the mother's back is shown, where they presented an amusing spectacle.

The little ant-eater occurs also in Brazil and other countries of South America. Its habits are similar to those of its more powerful species.

Von Sack, in his "Voyage to Surinam," gives an interesting account of the tame ones in his possession; and, after describing their characters, he tells us that the inhabitants of that country aver that when captured these animals cannot be induced to eat, and only lick their paws after the fashion of a bear. "When I obtained the first," he says, "I sent to the forest for a nest of ants, and during the interim I put into its cage some eggs, honey, milk, and meat, but it refused to touch any of them. At length the ants' nest arrived; but the animal did not pay the slightest attention to it either. By the shape of its fore paws, which resemble nippers, and differ very much from those of all the other species of ant-eaters, I thought that this little creature might perhaps live on the nymphæ of wasps, etc. I therefore brought it a wasps' nest, and then it pulled out with its nippers the nymphæ from the nest and began to eat them with great eagerness, sitting in the posture of a squirrel. I showed this phenomenon to many of the inhabitants, who all assured me that it was the first time they had ever known that species of animal to take any nourishment. The ants with which I tried it were the large termites upon which fowls are fed here." According to Von Sack and most observers, the tail is employed as a prehensile organ. It is larger than the body, very stout and broad at its origin, thickly clothed with short hairs, and much attenuated toward the extremity. Generally speaking, the fur displays a thick, soft, shining, woolly texture. The female, it is said, produces a single young one at a birth, although it is furnished with four mammæ.

In the Old World the ant-eaters are represented by the aard-vark and spiny ant-eater (*Echidna hystrix*), the latter a curious creature with a long, slender, toothless bill, with a palate armed with rows of strong sharp spines; the tongue is similar to that of the great ant-eater of South America, while the body is covered with quills like a porcupine. It is common in various parts of Australia, Port Moresby, New Guinea, and quite recently a new species has been discovered in Northern New Guinea.

The aard-vark, a South African ant-eater, is a strange-looking creature, and a very distinctive character is seen in the head, which has long-pointed ears; while the tail, being of moderate length, not so long as the body, is very thick, rounded at the root, and densely clothed with hair. Altogether it is a stout, heavy animal, the large bones of the neck, in particular, demonstrating its strength in the cervical region. The fur, which is very scanty, is generally of a grayish-brown color. The permanent teeth of the adult, twenty in number, have a simple form and structure, being made up of rootless cylinders, those in front displaying a slightly flattened aspect at the sides. It is rather larger than the common badger, attaining a length of upward of four feet. Its habits are nocturnal, and it constructs large subterraneous burrows with extraordinary rapidity. It ap

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pears to live entirely upon ants, and for this purpose the tongue is largely developed, and armed with a glutinous secretion. It is not so long, however, as in the true ant-eaters, while it is at the same time more flattened and attenuated. The aard-vark invariably fixes his retreat near to some large ants' nest, which he ventures only to attack after dark. He is a timid creature, and does not move far from his burrow; and when attacked, should he succeed in gaining access to his abode, it is next to impossible to get him out, for it is said he can burrow faster than his enemies can dig. According to those who have witnessed its method of procuring food, the aard-vark, having approached an ant-hill, forthwith proceeds to scratch a small part of it, just sufficient to allow of the introduction of its long, narrow snout. These ant-hills are sometimes three or four feet in height, and contain myriads of insect inhabitants—strongly ensconced in fancied security complete!

"Here," observes Mr. Ogilby, "after having previously ascertained that there is no danger of interruption, he lies down, and inserting his long slender tongue into the breach, entraps the ants, which fly to defend their dwellings upon the first alarm, and, mounting upon the tongue of the aard-vark, get entangled in the glutinous saliva and are swallowed by whole scores at a time. If uninterrupted he continues this process till he has satisfied his appetite; but on the slightest alarm he makes a precipitate retreat, and seeks security at the bottom of his subterranean dwelling. Hence it is that these animals are seldom seen, even in those parts of the country in which they are most numerous. Like other nocturnal animals, passing the greater part of their lives in sleeping and eating, they become exceedingly fat, and their flesh is considered to be wholesome and palatable food. The hind-quarters particularly, when cut into hams and dried, are held in great esteem."

There are some ants that these animals cannot face, and the so-called fire ants of South America will put to flight the largest ant-bears.

To any one who has handled the soft, velvety nose of these animals, it is a mystery how they are able to withstand the savage attacks to which they are subjected. The rapid movement of the snake-like tongue, however, is probably the secret of its boldness.

Our Ancestors.

BY GRANT ALLEN.

There are few questions more immediately interesting to Englishmen than the question: Who are our ancestors? From what elements and in what proportions are we compounded? May we consider ourselves as all pure Teutons? or are we partly Celts as well? Furthermore, may we even reckon among our immediate ancestry some still earlier and less historical races than either of these? Such questions are full of practical importance to ourselves, and they are also of a sort upon which modern investigations into language and the science of man have cast a strikingly new and unexpected light.

Of course, in considering the origin of Englishmen, we must look at the matter in no petty provincial spirit. We must include roughly in that general name Welshmen, Scotchmen, and Irisbmen as well; and if our friends in the north prefer to speak of Britain rather than of England, I am sure I, for my part, will have no objection. There are many learned modern historians, with Mr. Freeman at their head, who will tell us that Englishmen are almost pure-blooded Teutons, of the same original stock as the Germans, the Dutch, and the Danes and Norwegians. But when we come to inquire more fully into their meaning, it turns out that they are speaking only of the native inhabitants of England proper and the Scotch Lowlands, without taking into consideration at all the people of Wales, Ireland, and the Highlands, or the numerous descendants of immigrants from those districts into the southeastern half of Great Britain. Even in the restricted England itself, these same doughty Teutonic advocates admit that there is a nearly pure Celtic (or pre-Celtic) population in Cornwall, in Cumberland, and in Westmoreland; while the western half of the Lowlands, from Glasgow to the border, is also allowed to be inhabited by a mainly Welsh race. Furthermore, it is pretty generally granted by our stoutest Teutonic champions themselves, that the people of Dorset, Somerset, and Devon, of Lancashire, Cheshire, Shropshire, Herefordshire, and Worcestershire, are all largely mingled with Celtic blood. Thus, in the end, it appears that only the native inhabitants of the Lothians and the eastern and southern coast of England are claimed as pure Teutons, even by those who most loudly assert the essentially Teutonic origiu of the English people. We may possibly find that this little Teutonic belt or border itself is not without a fair sprinkling of earlier blood.

Perhaps the best way to clear up this question will be to glance briefly at the various races which have inhabited these islands, one after another, and then to inquire how far their descendants still exist in our midst, how large a proportion of our blood they have contributed, and whereabouts their representatives are now mainly to be found. Of course, in such an inquiry we can only arrive at very approximate results, for in our present advanced stage of intermixture, it is almost impossible for any man to say exactly what are the proportions of various races, even in his own person. Each of us is descended from two parents, four grandparents, eight great-grandparents, and so forth; so that, unless we could hunt up our pedigrees in every direction for ten generations, involving a knowledge of no less than 1,024 different persons at the tenth stage backward, we could not even say how far we ourselves were descended from Irish, Scotch, Welsh, or English ancestors respectively. As a matter of fact, every one of us is now, probably, a very mixed product indeed of Teutonic, Celtic, and still earlier elements, which we cannot practically unravel; and, perhaps, all we can really do is to point out that here one kind of blood is predominant, there another, and yonder again a third.

The men of the very earliest race that ever lived in England are probably not in any sense our ancestors. They were those black fellows of the palæolithic or older stone age, whose flint implements and other remains we find buried in the loose earth of the river-drift or under the concreted floors of caves, and who dwelt in Britain while it was yet a part of the mainland, with a cold climate like that of modern Siberia. These people seemed to have lived before and between the recurrent cold cycles of the great glacial period; and they were probably all swept away by the last of those long chilly spells, when almost the whole of England was covered by a vast sheet of glaciers, like Greenland in our own time. Since their days Britain has been submerged beneath several hundred feet of sea, raised again, joined to the continent, and once more finally separated from it by the English Channel and the Straits of Dover. Meanwhile our own original ancesters—the people from whom by long modification we ourselves are at last descended—were probably living away in the warmer south, and there developing the higher physical and intellectual powers by which they were ultimately enabled to overrun the whole northern part of the Old World. Accordingly, interesting as these older stone-age savages undoubtedly are—low-browed, fierce-jawed, crouching creatures, inferior even to the existing Australians or Andaman Islanders—they have yet no proper place in a pedigree of the modern English people. They were the aboriginal inhabitants of Britain; but their blood is probably quite unrepresented among the Englishmen of the present day.

Long after these black fellows, however, and long after the glaciers of the ice age had cleared off the face of the country, a second race occupied Britain, some of whose descendants almost undoubtedly exist in our midst at the present day. These were the neolithic, or later stone-age men, who have been identified, with great probability, as a branch of the same isolated Basque or Euskarian race which now lives among the valleys of the Western Pyrenees and the Asturias Mountains. They seem to have crossed over into Britain while it was still connected with the Continent by a broad isthmus, or, perhaps, even by a long stretch of land occupying the entire beds of the Channel and the German Ocean. Our knowledge of them is mainly derived from their tombs or barrows—great heaps of earth which they piled up above the bodies of their dead chieftains. From these have been taken their skeletons, their weapons, their domestic utensils, and their ornaments, all the latter objects having been buried with the corpse, for the use of the ghost in the other world. From an examination of these remains we are able largely to reconstruct the life of the Euskarian people—the earliest inhabitants of Britain whose blood is still largely represented in the existing population.

In stature the neolithic men were short and thickset, not often exceeding five feet four inches. In complexion they were probably white, but swarthy, like the darkest Italians and Spaniards, or even the Moors. Their skulls were very long and narrow; and they form the best distinguishing mark of the race, as well as the best test of its survival at the present day. The neoliths were unacquainted with the use of metal, but they employed weapons and implements of stone, not rudely chipped, like those of the older stone age, but carefully ground and polished. They made pottery, too, and wove cloth; they domesticated pigs and cattle; and they cultivated coarse cereals in the little plots which they cleared out of the forest with their stone hatchets or tomahawks. In general culture they were about at the same level as the more advanced Polynesian tribes, when they first came into contact with European civilization. The barrows which they raised over their dead chieftains were long and rather narrow, not round, like those of the later Celtic conquerors. They appear to have lived for the most part in little stockaded villages, each occupying a small clearing in the river valleys, and ruled over by a single chief; and the barrows usually cap the summit of the boundary hills which overlook the little dales. Inside them are long chambered galleries of large, rough-hewn stones; and when these primitive erections are laid bare by the decay or removal of the barrow, they form the so called "Druidical monuments" of old-fashioned antiquaries, a few of which are Celtic, but the greater part Euskarian.

At some future period I hope to lay before the readers of *Knowledge* a fuller account of these neolithic people and their existing remains. At present the points to which I wish to call attention are, first, the fact of their existence in early days in Britain; and, secondly, the fact that many of their descendants still remain among us to the present day. Nor do I propose in this paper to estimate the numerical strength of the Euskarian element in the population of the British islands as it now stands. It will be best to consider that part of the question at a later point in this series, when we have seen what were the subsequent races which overcame, and in part displaced, the aboriginal Euskarian folk. For the moment, it will suffice to point out that before the arrival of the Celts and other Aryan tribes in Britain these Euskarians spread over the whole of our islands, and were apparently the only people then inhabiting them. At least the monuments of this date—perhaps from 5,000 to 20,000 years old—seem to be similar in type wherever they occur in Britain, and to contain the remains of an essentially identical race. I shall also add here, by anticipation, what I hope to show more in detail hereafter, that their descendants exist almost unmixed at the present day as the so-called Black Celts in certain parts of Western Ireland and Scotland, and in a few places in South Wales; while their blood may be still traced in a more mixed condition in Yorkshire, Lincolnshire, East Anglia, the Scotch Highlands, and many other districts of England and Scotland. How they have managed to survive and to outlive the various later Celtic and Teutonic conquests we shall have to inquire when we come to consider the origin and progress of those subsequent waves of population.—*Knowledge.*

The Ribbon Manufacture of St. Etienne.

It may safely be said that St. Etienne is the largest ribbon producing town in the world. In speaking of ribbons, we mean all productions of the small ware looms, in which more than two pieces are woven at one time, and which include ladies' scarfs, ties, and similar goods. This industry is, with few exceptions, quite a domestic one. St. Etienne and district employs about 17,000 looms, of which only about 1,500 are driven by mechanical means, say 1,000 by water, and 500 by steam power. These 1,500 make partly plain silk ribbons, and partly velvet ribbons, the latter numbering about 600. Most of the weavers have not more than three looms, more frequently only one or two. Generally the master works one and the members of his family the others; sometimes he has also a journeyman. A loom costs from £32 to £100, according to its complexity, for some looms with Jacquard arrangements, and 7 to 12 shuttles for different wefts, are costly. When a journeyman has saved a few hundred francs he buys a loom, paying part of the price down and the remainder in installments as he makes his profit on it. When he has paid for the first loom, and takes a second one to be worked by an assistant, he becomes a member of the masters' guild, who fix the prices to be paid by the manufacturers. From the complicated nature of the work these wages cannot be always alike, but they are regulated according to the difficulty of the pattern, the quality of the silk, etc. If, for instance, a weaver receives a silk which is rather weak, and which necessitates frequent stoppages on account of broken ends, he calls in an expert, who, after examining his case, fixes the amount of the wages to be paid. On the other hand, the master finds it to be to his interest to pay good wages, and to give the weaver an advance when any new article which happens to be in fashion enables him to make extra profits himself. Where a master employs a journeyman he gives him half the wages earned by the loom, retaining the other half as hire for the loom and profits. In ordinary times a loom earns about 5s. per day, which leaves 2s. 6d. for the assistant (not very tempting wages our weavers will say). Sometimes, a loom can make as much as 12s. a day, against which, however, slack times must be taken, when the hands get no work, and after spending their wages have to find work in the neighboring mines or elsewhere for a time. They, however, seldom leave altogether, and stick to their homes as long as possible. The preparatory work of minding and spooling is paid by the day, generally from 1s. 3d. to 2s. for 10 hours' work. In 1848 the longest permissible time was fixed at twelve hours in summer and eleven hours in winter. With the ordinary sort of ribbons wages form about 10 per cent to 15 per cent of the price, but with the superior kinds the wages run up to 40 per cent. A singular feature is the fact that the weavers making silk ribbons are more steady and frugal, and work best at home, while those making velvet ribbons have not such a good reputation, and are also more frequently collected in larger numbers in factories. Can the latter fact affect their morals? is the question suggested.

New Street Letter Boxes.

New letter boxes are being placed in a portion of New York city. They are painted a bright red, so as to be seen from a long distance. Collections are made through a door that occupies the whole side of the box, and is more convenient for taking out large letters than the openings in boxes of the old style. A card is placed under a square of glass in the side of the box, on which is printed a list of the times at which collections are made. There is also in one corner a card on which is printed the hour of the next collection. This card is to be taken out by the collector at each trip, and another giving the time of the next collection is substituted. The card taken out is given to the superintendent on the return of the collector as a proof that the collection has been made. The number of the box to which it belongs is shown on each of these cards.

New Mineral Water from Amherst, British Burmah.

A mineral spring having been discovered in the Amherst district, which is attracting great crowds by the wonderful cures reputed to be performed by its waters, the authorities forwarded a few gallons for analysis by R. Romanis, D.Sc., Government Analyst. The following is the composition in parts per million:

Carbonate of lime	1,092·6
" " potash	57·8
" " soda	27·0
" " magnesia	23·2
Silicate of lime	31·1
Alumina and oxide of iron	12·8
	1,244·6

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Crystallization of Iron.*

BY N. P. BOWLER.

The theory that pieces of wrought iron or steel will crystallize by merely hanging for a certain length of time in a vertical position seems to be confirmed as true in this instance.

We had a chain in daily use in our foundry—used for raising flasks and castings—requiring it to hang in a vertical position most of the time. It had been in use probably eight or ten years. The links were of about one-half inch wire, as you can see by this piece of it. The service usually required was light compared with the ability of the chain. One day a link broke squarely off. The chain was sent to the blacksmith shop for repairs. The smith called my attention to the fact that if he put any of the links on end upon the anvil a light blow of the hammer would break them into four pieces. He tried several of them, and they broke as easily as poor cast iron. I asked him to put a link in the fire, heat it to a red heat, and let it cool gradually. He did so, and found it would not break then, but bend like good iron. I had the chain mended, and after emptying one of our large ladles of the molten iron, thus leaving it red hot, the chain was put into it to remain all night. That was done over three years ago. The chain has been in constant use ever since, with no signs of weakness by crystallizing.

We served all our chains the same way, by heating them and cooling gradually, and have had no recurrence of this kind. I would recommend that the ladle shanks used about the foundry be treated the same way.

A very interesting fact was related to me not long since by a division master mechanic of the Lake Shore and Michigan Southern Railway. He had just made two fire boxes for a couple of his engines from steel plate or homogeneous iron. They were completed, and the engines were ready to run; steam had been got up in both, and found all right.

The following day the fireman of one was told to fire up his engine, the same as he had fired the day before. After starting a pretty good fire, and seeing no signs of steam, he ran horror-stricken to tell his engineer that there was not a drop of water in the boiler, and that everything was red hot. The master mechanic, who happened to be there, quieted his fears by telling him to "never mind—just pull your fire and let the engine stand and cool off."

That was, I think he told me, ten years ago, and that fire-box has been in use all the time, and is good to-day; while its mate, made of the same material, lasted but a few years before it cracked and became useless.

Although that fire-box was not crystallized by using, yet is it not more than probable that the same conditions existed in this metal that we find in iron and steel that have become brittle by long usage—it becomes what is called crystallized?

There is no doubt that car axles become crystallized by long usage; but the time it takes to reach that point—when they are entirely unsafe to use—varies undoubtedly according to the good or bad quality of the iron. Some kinds of iron are brittle, and will soon fail, while others are of softer and more tenacious fiber, and require a longer time to crystallize.

The above facts suggest to me the feasibility and utility of converting old car axles into good ones, by merely annealing them.

It is the practice of master mechanics of railroads to condemn axles that have been in service a certain number of years, if for no other reason than that of being crystallized, acting on the theory that such an axle is unsafe for further use.

They are taken out and cast into the scrap pile, to be sold to the junk dealers for about one-third the price of new ones.

Some master mechanics that I know do practice the annealing of old axles, but by the number known to be for sale as scrap, one would think but very few did so.

The practice now is to increase the capacity of freight cars from what they were formerly—ten and twelve tons—to fifteen and twenty tons, thus making it necessary to take out the small axles; but when confidence can be put in these annealed ones, there will be no objection to using in narrow gauge cars axles once under standard gauge cars.

The crystallization of cast iron to such an extent as to make it unsafe for further use is still a mooted question. Railroad men in the early history of that enterprise, before the use of fish plates—believed that the car wheel, by striking the head of the rail, would become crystallized—and were disposed to remove all wheels from under passenger coaches, after having been in service a certain length of time, to be worn out under freight cars. What the length of time is, beyond which it was considered unsafe to run them, was never definitely settled. I think the practice has quite gone out of use, and the belief that chilled car wheels will crystallize by running so as to become unsafe is not very generally entertained.

Old car wheels are used to some extent in the mixture of iron for new ones.

I have, for a period of sixteen years, watched the appearance of those old wheels, as they were broken up, and I have been unable to notice any difference that could be charged to the time in service. We sometimes find wheels that have been made twenty years—of course, the amount of service they had done could not be known. Wheels ten years old are quite common, but that time had wrought changes in the metal was not perceptible by any means that I possessed. And my belief is that car wheels, at least, do not grow weaker as they grow older by reason of crystallization. It was but recently we had at the foundry some old cast shafting, and I noticed it particularly when broken up for the cupola, that there was no appearance of change in the metal, either by breaking or in looks, to indicate crystallization.

*A paper read before the Civil Engineers' Club, of Cleveland.

DISCUSSION.

In the after discussion of his paper, Mr. Bowler stated that he did not believe cast iron subject to crystallization; that during his long experience in the manufacture of car wheels, where large numbers are broken up, he had never seen a case of crystallization among them. He thought car axles might be so affected and that wrought iron is more subject to it when used in a vertical position.

Mr. Dunham—Was not your chain subjected to unequal strains by passing over a pulley?

Mr. Bowler—It did not pass over a pulley.

Mr. Bidwell cited a case at the Chickering Piano Works, where a vertical chain had broken from crystallization, without apparent cause, except what might be due to its vertical position.

Mr. Renschel, of the Cleveland Bridge and Car Works, thought that iron never crystallized unless overstrained. He thought that car axles are being constantly overstrained by a force that cannot well be estimated. The passing of the wheels over rail heads was but a succession of blows that result in overstrain, and crystallization follows.

Colonel Wilson, of the United States Harbor Improvement, mentioned the fact that he recently condemned a number of tons of bolts and spikes before being used, because they were crystallized. They could not have been overstrained.

Mr. Renschel—They were doubtless made from very poor iron at first.

Mr. Bidwell thought cold-drawn wire a good example of overstraining that does not produce crystallization.

Mr. Porter, of the King Bridge Works, stated that the experiments conducted by the United States Government went to show that no crystallization takes place where iron is not strained beyond one-half its elastic limit.

Mr. Latimer, Chief Engineer of the N. Y., P. and O. R. R., said that the question was once asked at a meeting of his roadmasters: "Is it not a fact that iron lasts longer, that it will sustain more wear, by allowing it to rest one day in seven?" The answer was not given.

The Horse Power of Turbines.

The power of water is its weight multiplied by the velocity, and in order to illustrate we will suppose a turbine wheel, working under 15 feet head, will discharge 3,168 cubic feet of water per minute, and utilize 80 per cent of the full power of the water. Multiply the cubic feet discharged per minute by 62½, which is the number of pounds each cubic foot of water weighs at the average temperature, and this product by height of head under which the wheels are working, and that product divided by 33,000 pounds, this number of pounds raised one foot high in one minute being one horse power, which will give the full horse power of 3,168 cubic feet per minute, under 15 feet head; and as no wheel will produce 100 per cent, the percentage the wheel in question is known to produce or utilize must be taken as the actual horse power, as in the example here given:

```
  3168   cubic feet per minute.
  62⅓    weight of one cubic foot.
 ------
  1056
  6336
 19008
 ------
197472 full weight of water.
    15 feet head.
 ------
 987360
 197472
 ------
33000)2962080(  89 76  full value of water.
  264000          80 per cent utilized.
 ------          ----
  322080  71·8080 net horse power, or 80 per cent
  297000           [of the full power of water.
 ------
  250800
  231000
 ------
  198000
  198000
```

It will be seen that the effective horse power at 80 per cent of the full value of the water is 71·80. We will now suppose the wheel had only utilized 60 per cent, then multiply the full value, 89·76, by 60, and the horse power would be 54·55. If the wheel would utilize 75 per cent, the effective horse power would be 67·32. From the explanation and example given it can easily be ascertained what number of horse power any wheel will produce, with a given number of cubic feet of water per minute, on any head, provided the percentage the wheel in question will utilize is known.—*Stout, Mills & Temple.*

New Process for Sewage.

The difficulty of dealing with the deposit technically known as "sludge," which has always and everywhere been a source of great trouble and inconvenience in treating town sewage by precipitation, has, it is claimed, been overcome by the Rivers Purification Association, Limited, at the Coventry Sewage Works, at Whitley. The various processes which have been tried by the association during the five years they have had the disposal of the Coventry sewage in their hands, have hitherto yielded anything but satisfactory results. The association tried, in succession, methods of drying the sludge by heat, and also by continuous rotary filtration. These processes, however, besides being costly, did not dispose with sufficient rapidity of the twenty-five or thirty tons of sludge which are precipitated at the works daily, and they were therefore abandoned, being succeeded by the present system of "pressing."

Some two years ago a model press was erected at the works, and although this description of press failed to fully answer the purpose for which it was intended, it has been very aptly described as the egg from which the process now adopted was hatched. The presses now in use were manufactured by Messrs. S. H. Johnson & Co., of Stratford, and the manager is Mr. E. F. Coddington. The sewage flows through a rotary sieve, by which the solids are extracted. The rotary motion of the sieve causes the solids to fall to its center, from whence they are conveyed by an archimedean screw. The sewage, now free from heavy suspended matter, is chemically treated, and the precipitated matter, called "sludge," is pumped into an iron trough which supplies two cylinders, and is forced from these into the presses by one of Johnson's patent air compressors. Once within the presses, the pressure is kept constant and uniform, and the water of which the "sludge" is chiefly composed pours out in continuous streams, leaving, at the conclusion of the process, the "sludge" in the form of dry, firm sewage cakes, 3 feet by 3 feet, 1¼ inches in thickness, and smelling faintly of ammonia. Thus, it is said, is performed in a few hours a task which was previously but imperfectly done in many months, and the sludge, which was before an almost unsalable commodity, now meets with a brisk demand, being readily purchased by farmers, one large cultivator of the soil having recently ordered a thousand tons.—*Building News.*

To Take Out Milk and Coffee Stains.

These stains are very difficult to remove, especially from light colored and finely finished goods. From woolen and mixed fabrics they are taken out by moistening them with a mixture of one part glycerine, nine parts water, and one-half part aqua ammonia. This mixture is applied to the goods by means of a brush, and allowed to remain for twelve hours (occasionally renewing the moistening). After this time, the stained pieces are pressed between cloth, and then rubbed with a clean rag. Drying, and if possible a little steaming, is generally sufficient to thoroughly remove the stains. Stains on silk garments which are dyed with delicate colors, or finely finished, are more difficult to remove. In this case five parts glycerine are mixed with five parts water, and one-quarter part of ammonia added. Before using this mixture it should be tried on some part of the garments where it cannot be noticed, in order to see if the mixture will change color. If such is the case no ammonia should be added. If, on the contrary, no change takes place, or if, after drying, the original color is restored, the above mixture is applied with a soft brush, allowing it to remain on the stains for six or eight hours, and is then rubbed with a clean cloth. The remaining dry substance is then carefully taken off by means of a knife. The injured places are now brushed over with clean water, pressed between cloths and dried. If the stain is not then removed, a rubbing with dry bread will easily take it off. To restore the finish, a thin solution of gum arabic, or in many cases beer is preferred, is brushed on, then dried and carefully ironed. By careful manipulation these stains will be successfully removed.

Old German Newspapers.

At the end of last year there were in circulation in Germany 4,413 newspapers. Of these 98 were older than the present century. Among them the *Frankfürter Journal*, 261 years old; the *Magdeburg Zeitung*, 253 years old; the *Leipziger Zeitung*, 221 years old; the *Jenaische Zeitung*, 207 years; the *Augsburger Postzeitung*, 195 years; the *Gothaische Zeitung*, 190 years; the *Vosetsche Zeitung*, 159 years; the *Berlin Intelligenzblatt*, 128 years; the *Kolnische Zeitung*, 84 years. There are 200 newspapers averaging from 80 to 50 years; 1,127 averaging from 50 to 21 years; 1,542 between 20 and 6 years; and 1,380 between 5 years and 3 months old. Altogether there are 1,491 German newspapers more than 20 years old. That a newspaper's existence in Germany is often a very ephemeral one may be inferred from the fact that 20 per cent of the newspapers which circulated through the German post office in 1880 came first into existence within the same year, and the average existence of those newspapers was not more than six months. Some have been more hardy, and have survived into the present year.

Formation of Alloys by Pressure.

W. Spring has shown that, when a mixture of bismuth filings, cadmium, and tin, in the proportions necessary for the formation of Wood's alloy, is subjected to a pressure of 7,500 atmospheres, the mass thus obtained powdered and again subjected to the same pressure, a metallic block is formed which has all the physical properties of the alloy. Its specific gravity, color, hardness, brittleness, and fracture are the same; and when thrown into water heated to 70°, it melts at once. In like manner Rose's metal was made by subjecting the proper mixture of lead, bismuth, and tin to high pressure. If zinc and copper filings are repeatedly subjected to pressure, a mass resembling brass is finally obtained.—*Berichte der deutsch. chem. Gesell.*

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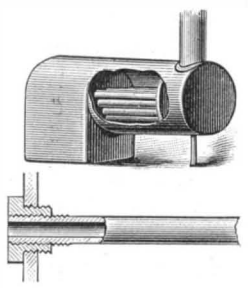
ENGINEERING INVENTIONS.

An Improvement in Boiler Flues.

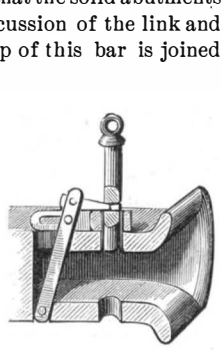
Mr. Horace L. Trout, of Troutsville, Botetourt county, Va., has patented an improved manner of attaching boiler flues to the flue sheets, that is shown in the accompanying engraving, in which the flue sheets are of the ordinary construction, each provided with a serics of opposite holes threaded on their peripheries. The flue for the passage of the products of combustion through the boiler is a straight tube, with a thread cut exteriorly on both its ends. The flues are connected to the flue sheets by copper nuts threaded on the outside to engage with threads in the hole in the flue sheet, and on the inside to engage threads on the outside of the pipes. In the ordinary construction the flues are inserted in opposite holes in the flue plates, and the ends of the flues are spread out and bent over or riveted to the flue sheets, and if it becomes necessary to remove a flue a skilled workman must be employed. By this construction it will be seen that the flues are detachable and can be inserted or removed by an ordinary workman, and they serve also as braces to the flue sheets. The inventor claims that by the employment of copper nuts a galvanic action is created between the copper nuts and the iron threads on the ends of the flue which prevents the iron threads from rusting, whereby their strength is impaired, and the copper nuts will not oxidize.



An Improved Car Coupling Device.

An invention for converting ordinary draw-bars of cars into automatic couplers with but little alteration of the draw-bar, and in a simple and inexpensive manner, securing to trainmen all the benefits of automatic coupling, is shown in the annexed cut.

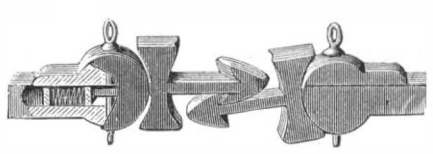
A is a draw-bar, such as is in ordinary use on cars. In the bottom of the draw-bar is pivoted a vertical trigger-bar, whose upper end projects through a slot cut in the top of the draw-bar just back of the pin hole. When this bar leans forward on its pivot it is in position to be struck by the entering link. When it moves back, however, it retires into a vertical recess made to receive it, so that the solid abutments of the draw-bar receive the main concussion of the link and the trigger-bar is protected. To the top of this bar is joined a latch that, when the coupling pin is raised, enters a hole near its lower end and holds it up to keep the pin steady and erect. When it is raised a detachable piece is placed upon the top of the draw-bar formed with an eye at its front end, and is connected at its back end to the trigger-bar, by which it is held in place, the eye encircling the pin and holding it in position to drop quickly down when the latch is removed. Various modifications of this device are shown in the drawings forming a part of the patent. For uncoupling the cars without going between them, to each end of the car is attached a bracket, which carries a pulley whose plane is parallel with the end of the car. To the pin is attached a chain which passes over the pulley to the outside of the car aud is held by a suitable fastening. To this chain, between the pulley and the pin, is fastened a ch .in that extends to the top of the car and is fastened, and by either of these the pin may be raised.



This device is patented by Mr. Charles E. Macarthy, of Forsyth, Monroe County, Ga.

A New Car Coupling.

Mr. Charles P. Williams, of Summit Point, Jefferson county, W. Va., has patented an improved automatic car coupler, illustrated by the accompanying engraving, in which the drawbar, provided with drawheads, has the usual opening for the reception of draw links or hooks. This opening is enlarged at its rear end, and is provided with opposite shoulders against which rest a rectangular plate, the plate being pressed against the shoulders by the tension of a spiral spring placed behind it, whereby an elastic bearing is furnished the link or drawhook in coupling cars. The drawheads are made semicircular on their upper and lower face, and the front end is curved. The drawhook is made of a rectangular plate provided with opposite shoulders near its rear end, and an arm adapted to enter the opening in the drawhead, and has a slot in its rear end for the passage of a coupling pin, which also passes through



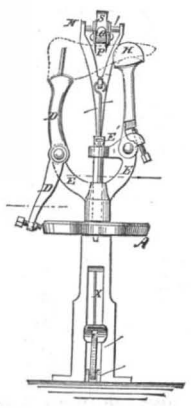
suitable holes in the drawhead. To the upper and lower faces of the drawhook are secured blocks whose inner faces next to the drawhead are cut away with the same radius as the circle of the end of the head, so that the drawhooks will be capable of a slight vertical motion on the arc of a circle whose center is the coupling pin. Their front faces are also cut in the arcs of vertical and horizontal circles, as shown. The forward end of the drawhook is rounded and provided on its upper surface with a curved plate, with a curved plate secured to it having a round convex edge extending from its rear part. A similar plate, except that its rear part is convex, is secured to the lower side of the drawhook. By this construction the drawhooks are adapted to rise and lower for cars of different height, and when coupled the upper convex plate of one hook riding under the lower concave of the opposite hook. They couple automatically when the cars are pushed together, and are uncoupled by a cord attached to the drawhook and extending to the top of the car. It will also be seen that should the cars leave the track they uncouple, and one car does not drag others from the track.

MECHANICAL INVENTIONS.

A Novel Lasting Jack.

A novel and ingenious device for lasting boots and shoes, shown in the accompanying drawing, is patented by Mr. George W. Hutchins, of Dover, Strafford county, N. H.

A is a frame, one end of which fits against a shoe bench and has perforated lugs to receive screws that fasten it to the bench. In the sides and outer end of the frame are formed deep recesses, and the forward parts of the edge, between these recesses, are curved so as to serve as a cam to guide the lower end of a lever, D. The lever is hinged to one end of a forked bar, which has a hub at its center to receive and work upon a spindle formed upon the frame, A. The other end of the forked bar has an arm projecting in formed upon it, that has a hole at its inner end to receive and work upon the upper part of the spindle, the forked bar being thus provided with two bearings to give it steadiness. To the end of this bar is hinged the lower end of an arm that has a concaved head formed on its upper end to receive and support the forward end or toe of the last.

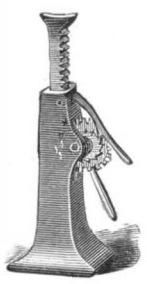


The heel of the last is perforated to receive a pin formed upon the upper end of the lever, D. Into a hole in the lower end of the lever is secured a set screw, the end of which rests against the cam formed on the frame, A, so that by turning the set screw the lever will be adjusted to receive large or small lasts. A lasting bar, M, is pivoted to lugs formed on the under side of the rear-middle part of the frame, A, and to a lug formed on its upper part a rod is hinged that passes down through a slot in the middle of the frame, A, and its lower end is attached to a treadle. To the upper part of the lasting bar is attached a curved arm hinged to the bar, and provided with prongs and springs holding the curved arm down and the hinged bar back, whereby the upper leather can be drawn into place upon the last. These devices are all adjustable to different sized lasts.

An Improved Lifting Jack.

An improvement in lifting jacks, as shown in the accompanying engraving, is patented by Mr. Johnathan Beihl, of Slippery Rock, Butler county, Pa.

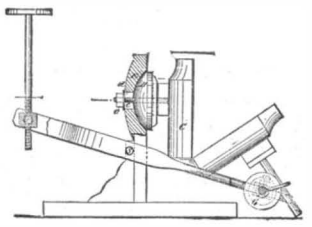
The standard of the lifting jack is made in two parts, one part being formed with a channel extending from its upper to near its lower end, and the other part serving as a face plate to cover the channel in the first part. In the channel is placed a rack bar which moves vertically, and which receives motion from a pinion journaled in plates secured to the face plate of the standard, and back of the plates is a slot in the face plate, through which the cogs of the pinion and of the rack bar engage. The shaft upon which the pinion is journaled is extended at one of its ends beyond the journal plate, and has a square enlargement, and a power lever is pivoted to this enlargement by a pin which passes through the lever and rests in a groove formed across one side of the enlargement. By this means the lever has a lateral motion to and from the pinion. The side of the pinion next to the lever is formed with projections with which the lever engages for turning the pinion to elevate the rack bar. The opposite side of the pinion is formed with a ratchet, with which a pawl, that is pivoted in a notch formed in the upper part of the frame, engages for holding the pinion from backward movement and holding the rack bar and weight at any desired point. This jack is simple, compact, cheaply made, and easy to operate.



Frame and Treadle for Glass Moulds.

A novel and ingenious invention relating to frames and treadles for holding and closing the moulds in which articles of glass are made, has been recently patented by Mr. Niles Granger, of Saratoga Springs, Saratoga County, N. Y. The invention is illustrated by the annexed cut.

To an upright standard extending from a cast iron bed is attached a vertically divided bottle mould, the two halves of which are connected together at their lower ends by a hinge. The mouth end of the mould is upright when it is closed. The mould section, C, has attached to its back a section of a ball, which is free to work or be adjusted in a socket in the upright part of the frame, the whole being secured together and adjusted by a bolt. This adjustment of the mould provides for setting it in a true upright position, which is very essential for making good and perfect work. The opening and closing section of the mould opens by its own weight when pressure is removed from a treadle with which it is connected, and that closes and controls it. This treadle is made in part of two side arms, which rock on bearings attached to the upright of the frame, and which are combined at one end with an adjustable crosshead, G. This crosshead is used for closing the mould and for letting the opening section down easily when opening under the pressure of the treadle. Arranged loosely upon the cross head is a grooved roller, in the groove of which the handle of the opening section of the mould rests, and by which the friction is reduced, and the roller being loose on its shaft and free to move, all sideways crowding of the mould is prevented.

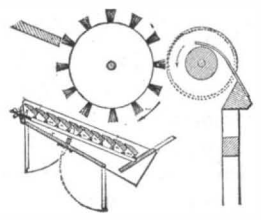


A Cotton Cleaning Attachment for Gins.

A device by which sand, dirt, or trash may be removed from cotton while it is being ginned is patented by Messrs. Jesse W. Thames and Robert I. Riley, both of Greenville, Butler County, Ala., and is shown in the annexed cut, in which *a* is the saw cylinder, *b* the brush cylinder, and *c* the flue of a cotton gin of ordinary construction.

In the flue, *c*, and at a proper distance from the brush, is placed a cleaner, extending out at the back part of the gin and forming the bottom of the flue. The cleaner has tapering side boards, the narrow ends of which are toward the back of the gin and are above the broader ends, and are connected by an inclined transverse board.

A series of movable slats are journaled in the side boards and adapted to rock therein like slats in and blind, and beveled so as to fit closely upon each other when the slats are shut. A rod passes transversely under the middle of the slats and is connected by a series of staples to eyes, one in each slat, whereby the slats are opened or closed in unison by moving the rod. A regulating screw which passes through the end board of the cleaner is secured to the upper end of the movable rod by which the motion of the slats is regulated and adjusted. Below the slats is a receptacle, closed with properly secured doors at the bottom, and in the center of which is placed a board to prevent too strong a current of air from the brush cylinder in the back part of the cleaner. When the slats are opened the current of air generated by the brush cylinder will carry the sand and dirt through the openings into the receptacle below them, the cleaned cotton passing over the tops of them into the lint room.

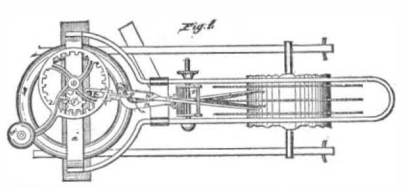


By the use of this cleaner those who run public gins can suit any customer by ginning his cotton just as he desires it.

Machine for Filing Gin Saws.

The accompanying engraving illustrates an improved machine for filing gin saws, patented by Mr. Elias W. South, of Anderson Court House, Anderson county, S. C.

With this machine the saw cylinder to be sharpened is removed from the gin and supported horizontally on trestles or other suitable manner, a plank being laid across the trestles in front of the saw cylinder for the support of the frame of the machine, pins on the under side of which pass through the plank and hold it in position. *a* is a vertical rectangular frame, to the sides of which are secured two curved arms opposite to each other. At the outer ends of their curves project two parallel straight arms, with an opening between them for the introduction of several of the saws of the saw cylinder, the ends of the arms being curved and joined together. A cranked shaft is journaled in the horizontal sides of the frame, and has secured to it a flywheel of usual construction. An interiorly geared wheel journaled by a short vertical shaft to the upper horizontal bar of the frame is provided with a handle by which rotary motion is imparted to a gear which meshes with a small pinion fast on the upper end of the crankshaft, and imparts a rapid rotary motion to the shaft. A short pitman is journaled to the shaft, the outer end of which passes through a hole in the curved end of the lower file holder. The upper and lower file holders are suitably connected together, and are so arranged that they cross each other, and a spring is placed between the rear bent ends, whereby the files are kept pressed together when in operation. They also pass through a loose guide to hold them in a proper position



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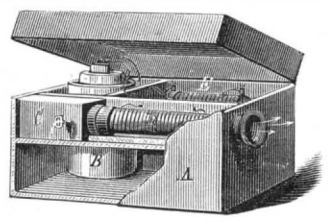
for their work. When the handle of the machine is turned a rapid vibratory motion is given to the files and the tooth of the saw is quickly and nicely filed.

ELECTRICAL INVENTION.

Apparatus for Continuous Production of Ozone.

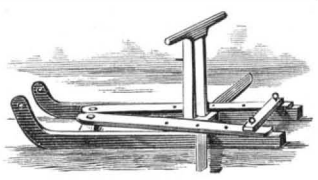
The engraving shows an improved apparatus for the continuous production of ozone, which has lately been patented by Theodore J. Yost, of Mahwah, Bergen county, N. J. In the engraving, B is a galvanic battery, and C a motor, consisting of spring power clockwork. D is the ozonizer, and E is an induction coil. The ozonizer is a glass tube attached at its inner end to a short metal tube, at its outer to the mouthpiece, *c*. A rod or wire is sustained centrally in the glass tube and covered by protecting material, put on in sections. The outer end of this wire connects with the induction coil, and a wire from the other end of the coil passes to the inner end of the glass tube, around which it is wound to near the outer end. Between the sections (before mentioned) are placed disks of metal foil having serrated edges that allow passage of air. The induction coil connects to the battery, E. A fan blower, run by the motor, C, being set in motion, a continuous current of air is forced through the ozonizer, and during its passage it is charged with ozone by the silent discharge of the electric current through the glass. The operations being automatic and continuous, a constant discharge of ozone takes place from the mouthpiece, *c*, and a comparatively small apparatus will answer all ordinary purposes.



AGRICULTURAL INVENTIONS.

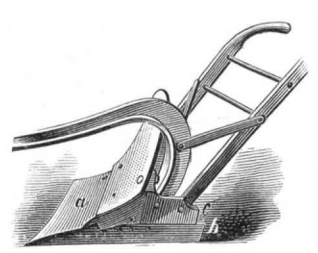
A New Cotton Stalk Cutter.

Among the new inventions we find a simple and ingenious device for cutting down cotton stalks, in preparing the ground for a new crop, that is patented by Mr. Francis M. Thompson, of McKinney, Collins county, Texas. It is clearly shown by the annexed engraving. A sled is constructed of such a width as to pass readily between the rows of stalks. And the lower parts of the runners are made thin, so that they will bed themselves in the ground to steady the sled against lateral movement. To the middle part of the front cross bar and at a little distance apart are hinged by bolts the forward ends of two adjustable bars, the rear ends of which are held at the desired distance apart by a cross bar located at the rear end of the sled and secured to it by pins or other suitable means. Several holes are formed in the adjustable bars and in the sled runners to receive pins, so that cutters can be adjusted to such a distance apart as the width of the rows may require. To the adjustable bars, a little in the rear of their centers, are securely attached the inner ends of two knives which incline to the rearward. They are also inclined downward, slightly, toward their outer ends, so that they will cut the stalks close to the ground as the machine is drawn forward between the rows. To the rear part of the sled is attached a platform for the driver while using the machine, and standards are provided to take hold of to give him more security. The device is intended to be drawn by one horse, or by two, driven tandem.



An Improved Plow.

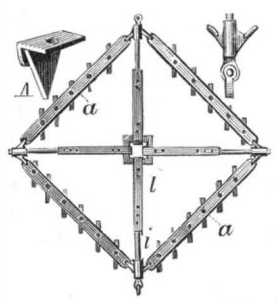
A novel arrangement of the parts of a plow is patented by Mr. Joseph George, of Fayetteville, Washington county, Ark. In the accompanying engraving *a* is the share and *b* the shaft bar of a plow, made in one piece. *c* is the land-side, having a lug secured to its inner face which projects below its lower edge and is bolted to the share bar, whereby the land-side and share bar are secured to each other. The forward end of the land-side is bent angularly to its plane, so as to form a wing through which a bolt passes, securing it to the mould board. The colter forms a continuation of the land-side, abuts against its front vertical edge, and projects beyond the mould board. It is provided with a front cutting edge and is bolted to the land-side and share bar. A brace having bent ends is attached at one end to the inner rear face of the share bar and at the other to the inner faces of the mould board and share. The handles are of usual construction, and bolted one to inner face of the land-side and the other to the mould board in the usual manner, and braces extend from the handles to the beam. The beam is curved near its end, so as to form a plow standard, and flattened out near its lower end and bolted to the land-side and share bar. It will be seen that by this construction the several parts of the plow are securely attached to each other, and the arrangement is compact.



An Improved Harrow.

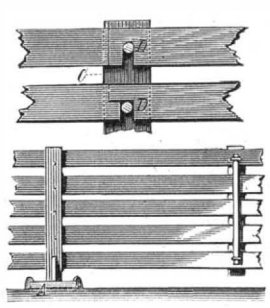
An ingeniously constructed harrow, in which all its parts in its movements in any direction will conform to the undulations of the ground, is patented by Messrs. Henry R. Burger and Joseph B. Simpson, of Fincastle, Botetourt county, Va., and is quite clearly shown in the accompanying engraving.

a a are the outer beams of the harrow to which the teeth are attached, and forming a square harrow. Each beam is formed of angle iron, the flange, *b*, of the iron projecting upward on the outer edge of the beam, thus making a harrow beam stronger and lighter than the ordinary construction. The ends of the beams are perforated to receive hooks that project upwardly from opposite corners of a triangular metallic block. This block has a central socket extending its entire length, into which is inserted an adjustable rod, *i*, which passes thence through a hole in a flange projecting downward from the metallic plate, *l* (provided with a series of adjustable holes), into any one of which the threaded inner end of the rod, *i*, may be inserted and secured by a nut. The inner end of these plates are formed into downward projecting hooks, each of which engages with the side of a central opening made in a metallic block placed at the center of the harrow. Clevises are secured to the outer ends of two of the rods, lying in line with each other. In the normal condition of the harrow the four beams form a square; but if it is desired to widen the harrow in one direction it may be readily accomplished by adjusting the inner ends of the rods, *i*, along the line in which the harrow is to be widened and placing them in holes nearer the outer ends of the plates, *l*. By this construction it will be seen that the outer harrow beams are pivoted to each other at the ends, and will conform to the undulations of the ground. The tooth of this harrow is triangular, the triangle being formed of sides of unequal length, and is attached to the side of the tooth holder by a bolt and nut passing through holes in the tooth that hold it at either of its angles, and the tooth holder is bolted to the frame of the harrow.



New Portable Fence.

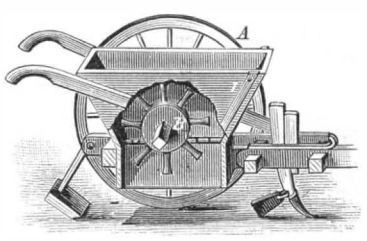
Mr. Oscar E. H. N. Reichling, of Marion, Grant county, Iowa, has patented an improved portable fence, that is easily erected or taken down and stands firmly when erected. The construction is shown by the accompanying cut. A base plate, A, is provided with a slot into which the lower end of the upright board, C, is placed. This board is provided with a series of apertures to receive the ends of transverse pins, D, which have a greater diameter in the middle than at the ends. The opposite ends of the pins are passed into an upright board corresponding with the first, but which rests on the base plate. The two uprights are then pressed together by means of wedges driven into the base plate through apertures provided for this purpose. The upright boards are prevented from coming together by the thickness of the middle part of the pin, D, and in the opening between the boards are placed the slats which have a shoulder formed at each end that rests upon the pin, D, and prevents swaying endwise. The upper slat is provided with notches in its under edge into which the pins, D, pass and thus serves to bind the several posts together. The slats are stiffened by means of a board, H, resting upon and crossing them on one side, and provided with a loop at the top and bottom, through which a bar is passed resting on the other side. The base plate is held to the ground by wooden spikes driven through it, or by pins having heads that catch on the plate.



The slats of any panel can be opened at any time, conveniently and rapidly, by removing the board, H, and the rod. This is easily done, as none of the parts are nailed together.

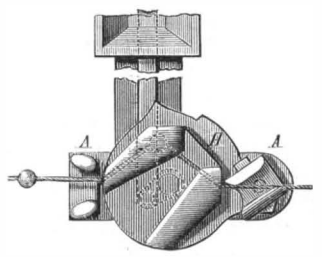
A Combined Cotton Planter and Fertilizer Distributer.

The device shown in the accompanying engraving is a peculiarly arranged and constructed cotton planter and fertilizer distributer combined. A A are wheels revolving on an axle B, and having on the inner ends of their hubs notched bands. The axle, B, is made square next to its journaled ends, and upon its squared parts are placed clutch bars, D, which may be moved upon the axle to enter or be withdrawn from the notches in the bands of the hubs of the wheels to cause the wheels to carry the axle with them in their revolution, or to revolve on their journals. The axle, B, is made round at its point of intersection with the frame, E, and its rounded parts revolve in bearings attached to the side bars of the frame, to the forward end of which is attached a tongue, and a hook to receive the draught. A hopper is placed over the middle part of the frame, E, and is attached at its corners to the upper end of four bars, I, the lower ends of which are attached to the frame. The ends of the hopper extend below the frame to serve as ends to the discharge chamber. The sides of the discharge chamber are hinged at their upper edges to the side bars of the frame, so that the opening may be larger or smaller for more or less seed or finer or coarser fertilizer to be distributed. To the square part of the axle within the hopper is attached a hub having radial arms, to force the seed or fertilizer into and out of the discharge chamber. To the middle forward part of the frame, E, is attached a plow to open a furrow to receive the seed, and to its rear is hinged a block to pack the sides of the furrow and prevent the soil from falling in. The furrow is filled and the seed is covered by a coverer attached to the rear part of the frame, E. By the above construction it will be seen that the machine may be used as a cart for carrying the fertilizer to the field by sliding the clutch bars along the axle so as not to engage with the hubs, and when the machine is at the field the clutch bars are made to engage with the hubs and the fertilizer distributed.



A Novel Check Row Corn Planter.

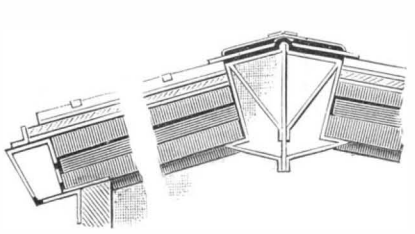
We find among the recent patents a novel device calculated to simplify and cheapen the construction, and insure accuracy in the operation of corn planters, of the class in which the seed dropping mechanism is operated by a cord or wire extending across the field. It is the invention of Mr. Lycurgus J. Bosworth, of Monmouth, Warren county, Ill., and is shown in the annexed cut. To the forward end of a frame, A, is attached a forked guide, to bring the cord into proper position for the balls attached to it at suitable distances to enter the guide channels attached to or formed upon the wheel, H. These channels allow the cords and balls to pass through freely, but have slots to their inner sides that will allow the cord, but not the balls, to pass through, and are made with an outward bend, near their rear ends, for the balls to draw against and turn the wheel, H. To the rear end of the frame, A, is pivoted a forked guide, the arms of which are made so that the pressure of the cord may have sufficient leverage to turn it, and to its base is attached a double pawl to engage with shoulders formed upon the rim of the wheel, H, to prevent the wheel from rebounding out of position. The channels in the wheel, H, are so arranged that when the rear end of either is opposite the rear guide, the forward end of the other will be opposite the forward guide. The wheel, H, is pivoted to a bearing attached to the frame, A, and to the lower end of the pivot is formed a crank to which is pivoted a seed dropping slide. With this construction the reciprocating motion of the wheel, H, will operate the slide and the seed will be dropped.



An Improved Skylight.

The accompanying engraving shows a peculiar construction, by which the metallic bars, curbs, and rafters of skylights are so adapted to each other that troublesome fitting is avoided, and strength, simplicity, and cheapness are secured. It is also formed so that the moisture resulting from condensation is amply provided for, and the glass securely held without the use of putty, at the same time allowing free contraction and expansion without permitting the glass to rattle.

This very desirable result is accomplished by the inventor by making the ridge bars of metallic plates, so bent as to form upper shelves and lower ledges when they are riveted to a central vertical plate. The ridge bar is strengthened by bracing plates reaching from the vertical plate to the upper shelves.



The rafter bars are also formed of bent plates having upper ledges, and in the center of the sides water gutters are formed. These plates are also riveted together. Upon the top of the rafter bars is placed a strip of felt, which has

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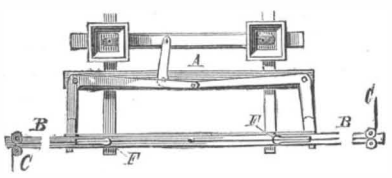
been dipped in lead and oil; upon this felt the glass is placed, and upon the glass another strip of felt. A hood is placed over the center of the rafters and ridge plates tha extends over the felting and glass, and is secured by any suitable means.

A curb is formed of a single piece of metal bent so as to inclose a chamber, and upon which the lower ends of the rafters rest. On its under side are formed angle shelves by which it is secured to the wall, and on its inner side are holes opposite the gutter on the side of the rafter through which the water of condensation escapes.

The patentee of this device is Mr. Frederick H. Leadley, of St. Louis, Mo.

A Novel Check Row Seed Planter.

A novel check row planter, in which the seed-dropping device is operated by means of a cord or rope that is staked across the field, is shown in the annexed engraving. A is a portion of the planter to which is attached the runners and seed boxes. B is a bar secured to the forward part of the planter, of such length as to reach half way to the nearest planted row on each side, and is provided at each end with two sheaves so arranged as to inclose the cord, C, and allow



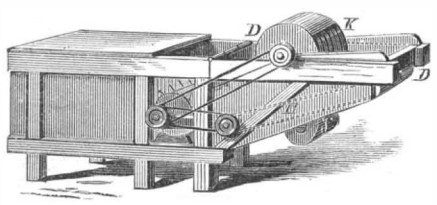
the knots on the cord to pass freely between them. At the rear of this bar are two crank levers, pivoted at their elbows to a suitable support, and having their adjacent ends pivoted together, and their opposite ends extended forward slightly beyond the bar, B. The forward ends of the crank levers are provided with journals on which are secured the loops of the guide arms, F, so that they shall be in line with the bar, B. These arms are constructed with loops at their upper ends, which are contracted at the bottom where friction rollers are placed, so that the cord, C, shall be allowed to pass freely through the contracted portions until one of its knots are drawn against the guide arm. The contracted portions obstruct the passage of the knots, so that as the planter moves forward they will be forcibly drawn against the guide arms, and the arms made to oscillate and allow the knots to pass through their loops at their larger portion. The lower ends of the guide arms are connected to the crank levers by rods that cross each other in the center, and are secured to the journaled end of the crank levers. For planting one row at a time, a dropping slide is connected to the crank levers so as to be moved back and forth on the longitudinal axis of the planter. For planting more than one row at a time, a third crank lever connected to a transverse dropping slide at one of its arms and to the former crank levers at the other is employed. By having two sheaves at each end of the bar, B, the necessity of changing the rope is avoided.

This ingenious and useful device is patented by Mr. Oliver L. Hall, of Parsons, Labette county, Kan.

A Band Cutting and Feeding Attachment for Thrashers.

Messrs. Samuel Caldwell and Jordan Burgess, of Greenfield, Highland county, Ohio, have patented a novel and ingenious improvement for cutting bands for and feeding thrashers. The accompanying engraving illustrates the device.

To the top bar of the frame, A, of a thrashing engine, and



in front of the cylinder, is hinged the inner end of a frame, D, which is supported in a horizontal position by inclined bars, E, that are attached at its outer end, and are in such position that their lower ends will rest in the angle between the front posts and the lower bars of the thrashing engine. The sides of the frames, D, have casing boards to prevent the grain from escaping laterally. Rollers are journaled to the outer end of the frame, D, and to the lower end of the inclined bars, E, over which passes an endless feed apron for carrying the grain to the thrashing cylinder. Beneath the inner part of the apron is placed a bottom to catch scattered grain, and also fan blowers, the discharge spout of which is of the same width of the endless apron, and is placed so as to direct the air blast beneath the apron and in the direction of the thrashing cylinder, thus preventing the grain from being carried back by the apron and clogging the machine. To the frame, D, at a little distance from its inner end, is journaled a shaft to which, at suitable distances, are secured circular cutters, K, made smooth or serrated, as may be desired. The cutters are driven by a belt connected with the shaft of the cylinder, and are covered by a curved plate to prevent accidents. In using, the bundles are laid upon the outer part of the endless belt, and as they are carried to the thrashing cylinder, their bands are cut by the rotating knives. The device is also hinged so as to be thrown upon the top of the thrasher for convenience in moving and to obtain access to the cylinder.

MISCELLANEOUS INVENTIONS.

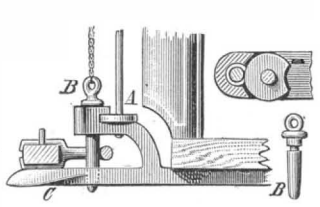
An Improved Sifter.

Mr. Augustus J. Frank, of Warsaw, Hancock county, Ill., has patented an ingenious and useful device for sifting flour or other comminuted substances. The device is shown in the accompanying engraving. A is a cup having in its lower part a sieve of curved form, the curve forming an arc of a circle, the radius of which is equal to the distance between the sieve and a slot, *a*, formed in the upper part of the cup. The cup has a handle, and a bottom below the sieve if preferred. The slot, *a*, in the cup is curved, and has its convex side down. In the opposite side of the cup, A, but near the sieve, is a slot longer than the slot, *a*, also having its convex side down. A funnel shaped vessel fits loosely into the cup, A, and

is supported by a stud and the shaker rod, that have bearings in the above described slots. A scraper is attached to the inside vessel for the purpose of sweeping the flour or other material over the sieve. When flour is poured into the inner vessel, it falls upon the sieve, and the shaker rod is moved with a reciprocating motion, causing the scraper to pass over the sieve and moving the flour, thereby distributing and sifting it.

A Novel Street Car Coupling.

A coupling of novel construction, for attaching horses to street cars and that is convenient and safe, has been lately patented by Mr. Ole A. A. Möldal, of Chicago, Cook county, Ill., and is illustrated by the annexed engraving. The engraving shows the platform, dashboard, and drawbar, C, of a street car. The forward end of the drawbar is widened and flattened to serve as a support for the double-tree, and in the bar just back of the widened part is a hole for the coupling pin. On the draw bar, at a little distance in the rear of the pin hole, is formed an arm which is curved upward and forward, and in its forward end has a hole to receive the coupling pin, the arm being of such length that the hole shall be directly over the pin hole of the draw bar. Between the curved arm and the draw bar is sufficient space to allow the double tree to have the necessary play. The forward end of the curved arm is thickened and has a recess formed in its rear side to receive the edge of a disk pivoted to it in the

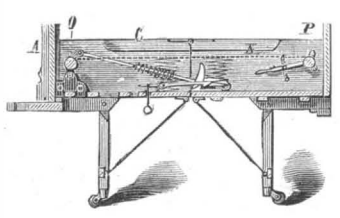


rear of the pin hole—the disk of such size as will enter an annular groove in the coupling pin, just below its head, and lock the pin securely in place. In one side of the disk is a recess of such size that when the disk is turned to bring the recess next the pin, the pin can be inserted or withdrawn freely. The rod to which the disk is attached passes up through a guide hole in an arm attached to top rail of the dash board, and has a handle hinged to its upper end in such position that when the handle is turned down upon one side of the bar, the recess in the disk will be turned away from the pin and the pin locked in place, and the handle turned in an opposite direction, the pin can be inserted and removed. The coupling pin is raised and lowered by a chain.

An Improved Folding Bed.

Messrs. Joseph Novak and Joseph Strobel, both of Chicago, Cook county, Ill., have patented certain novel and useful arrangements of parts of folding beds, which are shown in the accompanying engraving.

A is a bedstead which folds together at the center, the folding hinges of which are attached to the adjacent ends of the strip, C, hinged to the upper edges of the side-boards of the bedstead that are recessed to receive the said strips. When the bedstead is opened the strips, C, are turned down against the sides to lock it open. Latches are hinged to one part of the bottom of the bedstead in such a position that they will engage with catches attached to the bottom of the other part. The latches are held in gear with the catches by wire springs attached to them and to a hinging rod, with which the latches are rigidly attached. On the ends of the hinging rod are formed arms, which project in the opposite direction from the latches, so that the latches can be raised by operating the arms by cords attached to

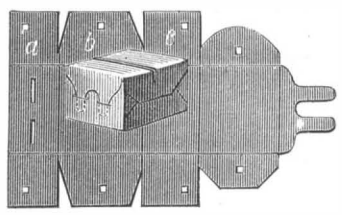


them, which pass out through the bottom of the bedstead. The bedstead is supported upon legs having casters attached to their lower ends, and are hinged at their upper ends to supports attached to the bottom of the bed.

Brace rods are hinged to the lower ends of the legs and the bottom of the bedstead near its hinged joint. With this construction the legs are in a vertical position when the bed is opened, and are held against the bottom of the bedstead when it is folded. N is a woven wire mattress, the respective ends of which are attached to the bar, O, and roller, P, and to the bar and roller are connected levers and springs, by which the mattress is given proper tension when the bedstead is open. The middle part of the mattress is supported by spiral springs secured to the bottom of the bedstead.

Paper Box.

The invention shown in the annexed engraving is a new construction of a folding box having its body and cover in one piece, so that it can be set up without paste or other adhesive material. The blank, of which the body portion of the box is formed, is cut so as to form the flaps, *a*, *b*, *c*, and the cover portion so as to form the flap, *d*, and the fastening flap. The blank is then scored in such a manner that corresponding square portions form the bottom and cover, and other corresponding rectangular portions form two sides of the box, the other two sides being closed by the folding in of the flaps of the main body of

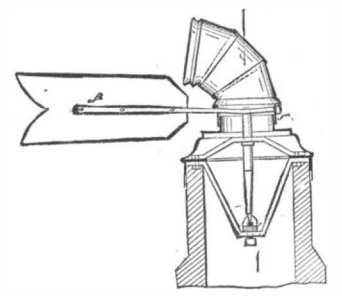


the box. The front side portion of the box has slots formed through it to receive the ends of the locking flaps. The flaps of the body and cover are perforated to receive a cord or tape to secure the box in a folded position. It will be seen that the box and cover are complete in one single piece, and that it can be cheaply made and easily set up for use without paste, and when unfolded lies in a perfectly flat condition, occupying very small space for shipping or storing.

Chimney Cowl.

Mr. Charles S. Hempstead, of Masontown, Fayette County, Pa., has patented a new and useful improvement in chimney cowls that is shown in the annexed cut.

A is a vane attached to a chimney cowl, the cowl being attached to a chimney cap, which has an ornamental outline, and is formed with a circular collar on its upper side, and from its under side extend right angled flanges, that surround the chimney on the outside and rest upon its top, as shown. To the under side of the right angle flange on the top of the chimney is attached a downwardly bent bar that extends down into the chimney, in the bottom portion of which is formed a step in which the vertical spindle of the cowl is journaled. Upon the upper side of the above mentioned flange is

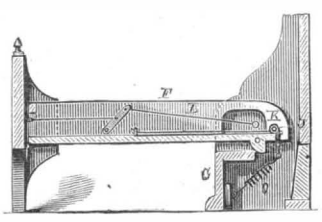


placed an upwardly bent bar, which is perforated in its center and forms the journal for the upper part of the cowl spindle which extends above the collar of the chimney cap, where it is reduced in size and forms the pivot for the arm of the vane. Upon the vane arm is placed a collar, J, which surrounds the collar of the chimney top and turns with the vane. The cowl is mounted on the upper edge of the collar, J, and is secured to it so that the cowl is adapted to be turned upon the collar for setting it, so that its opening will be toward or from the vane, as desired.

An Improved Wardrobe Bedstead.

In the accompanying engraving a novel and conveniently operated wardrobe bedstead is shown, which has lately been patented by Mr. Townsend Saxton, of Brooklyn, Kings County, N. Y.

In the engraving A is a head board, the sides, B, of which are made wide at their lower parts and gradually decrease to their upper ends. To the lower part is attached a weight which rests upon blocks secured to the sides and designed to hold the head board in place while the bed is raised or lowered. To the forward edges of the lower part of the sides, B, is attached a front board, C, from the upper edge of which a top board extends inward to such a position that the bottom of the side boards, F, will stand near it when they have been raised to a vertical position, and the space between them is closed by a moulding. The sides, F, are pivoted to the sides of the headboard by a rod attached to its sides and to the bottom of the side boards at a little distance from their ends. The upper corners of the side boards are rounded to allow the end and bottom of the boards to come as close as possible to the headboard. The ends of the side-boards are attached to the ends of a rod, J, upon which is placed a spiral spring, K, which is coiled in opposite directions from the center toward its ends. A loop is formed in the middle of the spring, through which and under the rod, J, is passed a rod, L, which passes



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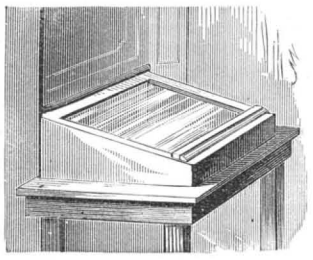
along the bottom of the bed, and its other end is passed through a staple in the bottom.

The ends of the spring, K, are extended downward to serve as levers, and to them are secured the spiral springs, O. This construction so balances the weight of the bed that it is easily raised or lowered.

The foot-board is hinged to the bottom of the side-board, so that it stands at right angles to it when the bed is lowered, and by means of rods and a lever it automatically takes a position parallel to the bottom when the bed is folded, and serves as a cornice.

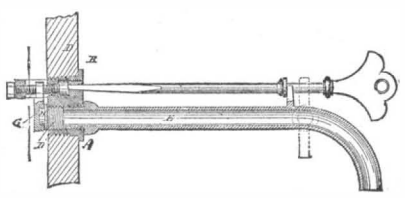
A Novel Tracing Desk.

Mr. Edward T. Gibson, of Fort Washakie, Sweetwater county, Wyoming Ter., has patented a transparent desk of novel construction for tracing purposes. This device (shown in the accompanying drawing) is a narrow table, upon which is supported an inclined desk, consisting of a three-sided rectangular base, upon which is secured in an inclined position a frame, and a plate of glass is let into the frame. Near the lower edge of the frame is secured a strip which serves as a rest for a sheet of paper placed on the glass, and a similar piece placed above the strip will hold the two sheets together. To use the desk in making tracings from sheets of paper it is to be placed close in front of a window, with the upper border of the inclined glass plate and the open side of the base toward the window. The window curtain, which should be opaque, is then lowered until it reaches the upper edge of the desk, so as to limit the entrance of the light to the open side. The object to be traced is then placed on the glass plate, and over it is placed the blank paper or lineu that is to receive the tracing. By this device the light illuminates the paper and object to be traced, so that a copy is easily taken.



An Ingenious Faucet.

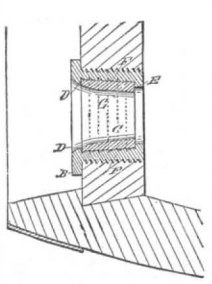
A new faucet that can be fastened in a barrel or cask, without causing a loss of any of its contents, has been recently patented by Mr. Gustav A. Naumann, of Newark, Essex county, N. J., and is shown in the annexed engraving. A screw plug, A, is provided with a flange, B, having two opposite notches for applying a key to screw it into the barrel head. It may be made beveled instead of with a thread and driven into the aperture. It is provided with a threaded aperture, D, into which a bent tube is screwed, that has a notch or recessed projection upward, when the bent end is downward. A valve, G, having a packing strip fitting over the inner end of the aperture, and is guided in its movements to and from this aperture by guides projecting from the inner surface of the plug, and are united at the ends by a transverse piece. A screw on which the valve, G, is loosely mounted, is mounted in the transverse piece. The outer end of the valve screw has a head in which is a squared aperture to receive the squared end of a key. The plug, A, is preferably secured to the barrel when it is empty, and when it is secured the valve, G, rests against the aperture, D, and closes it. If any of the liquid is to be drawn the bent tube is screwed into the aperture, D, and the key is inserted in the aperture in the head of the valve screw, and when the key is turned the valve, G, will be moved, and the aperture opened, and when the key is reversed the valve will be closed.



Bushing for Barrels.

Mr. Thomas J. Loftus, of Sacramento, Sacramento county, Cal., has patented a device for preventing the aperture in barrel heads, into which the spigot is driven, from being unduly enlarged, that is clearly shown in the accompanying engraving.

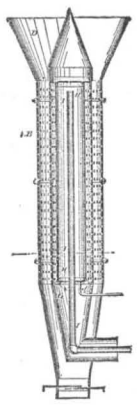
A bushing made of any suitable metal is provided with an external screw thread, and with a flange at its outer end. It is also provided with an annular recess on its inner surface, whereby an annular ridge will be formed at the outer and inner ends of the bushing. The recessed inner surface of the bushing is further provided with a series of circular grooves, forming projections toward the rear end of the bushing. The inner surface of the bushing is slightly beveled from the outer toward the inner end. A short tubular lining of wood or other suitable material is driven into the bushing until its sides pass into the recess in the inner surface of the bushing, and the same will be held by the front ridge and the circular projections. The bushing is then screwed into the aperture in the barrel head. A cork or other stopper is driven into the bushing, and when the barrel is to be tapped the cork is driven into the barrel by the spigot, and the packing of the bushing causes it to fit tightly, preventing leakage. If the opening for the spigot becomes too large the packing of the bushing may be removed and replaced by a new one, and thus remedied without requiring a new head to the barrel.



Grain Drier.

A new and useful improvement in grain driers has recently been patented by Mr. Henry R. Heffner, of Circleville, Pickaway county, Ohio, and is shown in the accompanying drawing.

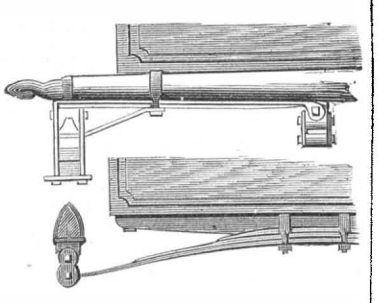
A is an upright hollow cylinder of any desirable length or size, and is finely perforated, and it may be supported in an upright position by a suitable frame. Within this cylinder is placed concentrically a smaller cylinder, B, also finely perforated, and is connected with and supported from the cylinder, A, by bolts that also serve to distribute the grain as it passes through the space between the cylinders. To the upper end of the cylinder, A, is attached a hopper to guide the grain into the space between the cylinders, and to the upper end of the cylinder, B, is attached a conical top to prevent the grain from lodging on its top. In the lower part of the cylinder, A, are located slides by which the discharge opening can be regulated to detain the grain a longer or shorter time in the drier, as its dampness may require. The moisture expelled from the grain by the heat escapes through the perforations of the cylinders. When the grain is to be dried with hot air the air is introduced at the bottom of the cylinder, B, through the outer cylinder by an air tube connected with a heating chamber. When the grain is dried by steam a steam-tight cylinder is suspended within the cylinder, B, to which steam enters through an opening in its lower end, through which passes a pipe that extends nearly to the upper end of the chamber. The cold air and water of condensation are drawn off through a small pipe also connected at the lower end of the cylinder, and passes out through the sides of the cylinders, A B. With this device steam or air may be used, and the grain used without changing the construction.



An Improvement in Side-bar Vehicles.

A new thing in side bar vehicles has lately been patented by Mr. Charles E. Lee, of Louisville, Jefferson county, Ky., and is illustrated by the accompanying engraving. In the improved vehicle the side bars are each provided on its under face with a longitudinal groove, extending the entire length of the side bar, and adapted to receive tongues of T-shaped metallic plates, the bottom plates of which are secured to the under face of each of the side bars by suitable fastenings, thus greatly strengthening the side bars and increasing their rigidity.

On the under face of the side bars, near their ends, are placed springs, the upper and lower leaves of each of which are provided with ears at their outer ends, and are secured to the bars by clips. To the ears of the springs is secured by cross bolt a coupling, to the lower end of which is attached, by a longitudinal bolt, one end of a cross spring, the opposite end of the spring being secured to an opposite coupling similarly constructed. Wooden cross bars are secured to the middle of the cross springs by means of clips, and to these bars the body of the vehicle is secured. By this construction it will be seen that the body is adapted to move up and down by means of its spring connections with the side bar.

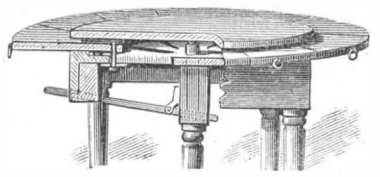


The head block is connected to the front end of the side bars on their under sides by clips which embrace the side bars and pass through the head block, and the rear end of the side bars are secured to the hind axle also by clips. By this construction the side springs are firmly attached to the side bars, head block, and hind axle, and the side bars are firmly secured to the front bolster and hind axle, forming a rigid frame, to which side and cross springs are attached.

An Extension Circular Table.

A novel and ingenious device, by which a circular dining table can be readily extended in size around its entire rim or in any portion of it, is shown in the accompanying engraving.

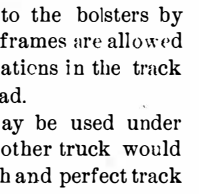
A is the main table fixed on legs and provided with a rail at and below its outer edge. At the center, in an aperture formed in the table and middle leg, is a tube that receives the pivot of a circular top piece, so that it is free to revolve. The tube rests at its lower end on a lever by which it, with the top, can be raised and lowered, and a suitable catch is provided at its outer end for retaining the lever in place. On the table, A, are rollers which support the circular top at its edges and relieve the friction. The extension portion or rim is composed of segment leaves, C C', fitted to slide radially, which, when drawn out, fit closely together and form a complete rim around the table. The segments are placed alternately above and below the fixed table, A. The upper segments, C, rest on this table and are provided with headed pins that extend through slots formed in the table, by which the segments are guided, and also retained in place when drawn out. The lower segments, C', move in apertures formed in the table rail, and are provided with headed pins passing through slots in the table, by which the rear ends of the segments are supported and their outward movement limited. The rear portions of these segments are recessed and raised to the level of segment, C, after being drawn out, and to support them in this position slide blocks are placed beneath the raised segments. By placing the segments in two sets, above and below the table, space is obtained for closing together at their inward movement; and the combined surface of each set being nearly equal to the fixed table, A, the extension more than doubles the surface of the table. The leaves may be drawn out one or more at a time, and extending the table in one or more directions. The revolving circular top is used for receiving dishes and allows them to be brought in front of each person readily.



This device is patented by Mr. John F. Schultz, of New York city.

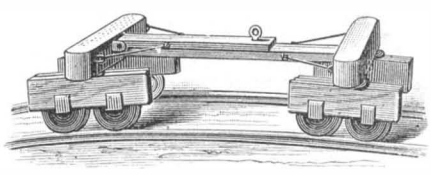
A Novel Table Leaf Support.

Messrs. Josiah H. Mosher and George E. Crane, of Portland, Ionia county, Mich., have patented a new table-leaf support, of which the accompanying engraving is an illustration. A is the arm or support for the leaf, and B is a guide plate through which the free end of the rod moves. This plate is angular in form, and the horizontal portion is formed with a slot, and the vertical portion with an opening of greater width and connected with it, thus forming shoulders at the vertex of the angle of the plate. The support is hinged to a plate, E, properly secured to the table-leaf. The main portion of the support is made of such a size as to pass freely the slot in the guide plate, but the outer end is enlarged so as to almost fill the opening in the plate, and is formed with side stops, which, when the leaf of the table is raised, engage with the shoulders of the guide plate and hold the leaf in a horizontal position. To lower the leaf, it is only necessary to raise the outer end of the support so that the shoulders will disengage each other. When the leaf drops down the support will be held by the slot of the plate, in an inclined position ready to follow down the plate to automatically engage with its shoulders when the leaf is again raised.



An Ingenious Car Truck.

The engraving is an illustration of railway car trucks of novel and ingenious construction, adapted for use upon rails without ties or upon any temporary railway having sharp curves either from a vertical or horizontal plane, such as may be laid upon an uneven surface without grading. To accomplish this result, truck frames that are swiveled independently of each other to opposite sides of the running gear, by means of bolts, pass through the ends of the bolsters. Each truck frame is provided with two wheels, arranged one in front of the other, and the wheels are constructed with a double flange, adapted to overlap the rail on both sides, so that they shall be braced without the use of ties. The tread of the wheel is made slightly broader than the rail, in order that the wheels shall keep the track in turning a sharp curve. It is obvious that with this construction there is less wear and strain on the rails than where the trucks are rigidly connected together.



Each of the bolsters is provided with a reach that is hinged so as to oscillate vertically, and they overlap each other so as to be secured and adjusted by means of a bolt passing through perforations in both, and are braced on opposite sides by rods that are connected to the bolsters by flexible joints. By this means the truck frames are allowed to accommodate themselves to any undulations in the track without disturbing the position of the load.

It will be seen that this car truck may be used under exceptional conditions where almost any other truck would be useless, owing to the fact that a smooth and perfect track is a condition of their usefulness. This invention is patented by Messrs. Alanson A. Blackman, Elhanan Blackman, and Hyrcanus Blackman, all of Snohomish, Snohomish county, Washington Ter.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

16 ft. Steam Yacht, very cheap. Box 10, Bridgeton, N.J.

Lathes.—20 inch swing, 8 foot bed, ready June 1. F. C. & A. E. Rowland, New Haven, Conn.

Excelsior Metallic and Steel *Tapes*. The most durable and the handiest made. General depot, Keuffel & Esser, New York.

A novel without a plot in it would be as rare to find as a stationer's stock without Esterbrook's Pens.

Wanted, a Mechanical Draughtsman, acquainted with stationary engine and general machine work. Machinist preferred. Address T. E. J., P. O. Box 773, New York.

THE SINGER M'F'G CO.'S CASE FACTORY, SOUTH BEND, IND.

H. W. Johns Manufacturing Company, New York.

GENTLEMEN: Some of your Asbestos Roofing was used to cover our dry kilns during 1879, and at this date is in good order. The under side of the roof is exposed to steam and acid generated in drying lumber, and a temperature of 250° heat; while the roof rafters and sheathing have cracked by the heat, your roofing shows no sign of damage. Tin roofs, painted both sides, used to last but a few months, while the ordinary gravel roofs are useless on our kilns. Yours very truly. L. PINE, Supt.

A thoroughly competent Foreman in an Organ Factory wanted. Address Lock Box 85, York, Pa.

Drop Forgings. Billings & Spencer Co.

"T. New, 32 John St. New York, has sold and applied over fifty million feet of his Prepared Roofing, the major part being placed upon manufacturing establishments."—SCIENTIFIC AMERICAN.

Agents Wanted.—None but intelligent and energetic need apply. Must furnish good recommendations, or no notice will be taken of applications. Exclusive territory given. Agents are now making from $10 to $15 a day. Address, for terms, The Infallible Coin Scale Co., 267 Broadway, New York city.

Improved Skinner Portable Engines. Erie, Pa.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users & engineers. (Forward above by postal or letter; mention this paper.)

Steel Stamps and Pattern Letters. The best made. J. F. W. Dorman, 21 German St., Baltimore. Catalogue free.

Abbe Bolt Forging Machines and Palmer Power Hammers a specialty. S. C. Forsaith & Co., Manchester, N.H.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Presses & Dies (fruit cans) Ayar Mach. Wks., Salem, N.J.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Cope & Maxwell M'f'g Co.'s Pump adv., page 263.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

List 27.—Description of 3,000 new and second-hand Machines, now ready for distribution. Send stamp for same. S. C. Forsaith & Co., Manchester, N.H., and N.Y. city.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 270.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

The Sweetland Chuck. See illus. adv., p. 270.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville, N.J.

4 to 40 H. P. Steam Engines. See adv. p. 285.

Supplee Steam Engine. See adv. p. 221.

Saw Mill Machinery. Stearns Mfg. Co. See p. 286.

See Bentel, Margedant & Co.'s adv., page 304.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Machine Diamonds. J. Dickinson, 64 Nassau St., N.Y.

The Berryman Feed Water Heater and Purifier and Feed Pump. I. B. Davis' Patent. See illus. adv., p. 304.

Telegraph, Telephone, Elec. Light Supplies. See p. 306.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 10 cents per pound. Fully warranted

For Pat. Safety Elevators, Hoisting Engines. Friction Clutch Pulleys, Cut-off Coupling see Frisbie's ad. p. 304.

Elevators, Freight and Passenger, Shafting, Pulley, and Hangers. J. S. Graves & Son, Rochester N. Y.

Gould & Eberhardt's Machinists' Tools. See adv., p. 306.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 304.

Centrifugal Pumps, 100 to 35,000 gals. per min. See p. 304.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 305.

Lehigh Valley Emery and Corundum Wheels are free cutting, durable, and safe. Can be adapted to all kinds of work. Write for prices, stating sizes of wheels you use. Lehigh Valley Emery Wheel Co., Lehighton, Pa.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 305.

Cutters for Teeth of Gear Wheels formed entirely by machinery. The Pratt & Whitney Co. Hartford, Conn.

Steam Pumps. See adv. Smith, Vaile & Co., p. 306.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Common Sense Dry Kiln. Adapted to drying of all material where kiln, etc., drying houses are used. See p. 306.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

NEW BOOKS AND PUBLICATIONS.

CLARK'S NEW SYSTEM OF ELECTRICAL MEDICATION. By A. W. Tipton, M.D., Jacksonville, Illinois: The Author. 8vo, leather. $4.

A revised and enlarged edition of Daniel Clark's treatise, first published in 1866. Since that date Dr. Tipton has brought out several editions at his own cost, thus proving the fervency of his discipleship. He believes that the electric current, applied as Clark's theory directs, in connection with other remedies, is a valuable curative agent. How far the theory bears the test of practical applications at the hands of others does not appear.

NEW YORK WATER SUPPLY. Department of Public Works. 8vo, cloth. pp. 64.

Commissioner Thompson's report on a proposed new aqueduct and storage reservoir for additional supply from Croton River, with detailed report of Isaac Newton, Chief Engineer of the Croton Aqueduct, and opinions of consulting engineers. The latter report contains a large amount of information with regard to the present and possible scope of New York's water supply from the Croton Valley and the Housatonic River. It carries an excellent map.

HOW TO MAKE PICTURES: EASY LESSONS FOR THE AMATEUR PHOTOGRAPHER. By Henry Clay Price. New York: Scovill Manufacturing Company. Cloth, pp. 92.

The simplicity, cheapness, and portability of the apparatus employed in dry plate photography has enabled the camera to more than supersede the sketch book for travelers, students, and others, who wish to keep permanent memorials of scenery, buildings, or other objects of nature and art which may seem worthy of remembrance. This little handbook sufficiently describes the apparatus used by such amateur photographers, and so much of the art of photography as they may need to know to make a good beginning.

ANNUAL REPORT OF THE FRUIT GROWERS' ASSOCIATION OF THE PROVINCE OF ONTARIO FOR THE YEAR 1881. 8vo, pp. 136.

ANNUAL REPORT OF THE ENTOMOLOGICAL SOCIETY OF THE PROVINCE OF ONTARIO FOR THE YEAR 1881. 8vo, pp. 85. Toronto: printed by order of the Legislative Assembly.

These two reports bound together make a creditable volume. The first indicates a promising interest and progress in Canadian fruit growing, forestry, and kindred subjects. The second contains much useful information relative to Canadian insects.

A SYSTEMATIC HANDBOOK OF VOLUMETRIC ANALYSIS. By Francis Sutton, F.C.S., F.I.C. Philadelphia: Presley Blakiston. Cloth, pp. 471. $5.

Working chemists need no introduction to this standard treatise. For this fourth edition the work has been carefully revised, and so far as the progress of chemistry has made necessary, rewritten.

AMERICAN CHEMICAL JOURNAL. Edited, with the aid of chemists at home and abroad, by Ira Remsen, Professor of Chemistry in the Johns Hopkins University. Baltimore: Published by the editor, 6 parts a year. pp. 400 to 500. Price $3. Single number, 50 cents.

The third year and volume of this valuable periodical have just been completed. As a record of original research in chemistry its standing is unsurpassed in English. The frequent reviews of recent progress in the several departments of applied chemistry constitute a feature of wide practical value and interest.

YENSIE WALTON'S WOMANHOOD. By Mrs. S. R. Graham Clark. Boston: D. Lothrop & Co. $1.50.

The author tells us that this is not a book for critics, but for the sorrowing, burdened toilers of her own sex, which bars an opinion here. It is a high tension, Sunday-school library love story.

INTERIORS AND INTERIOR DETAILS. INTRODUCTION, DESCRIPTION OF PLATES AND NOTES ON WOOD FINISH. By William B. Tuthill. New York: W. T. Comstock. Quarto, cloth. 52 plates. $7.50.

A comprehensive and valuable series of suggestions for architects and architectural designers, reproduced from original drawings by prominent architects in New York, Boston, Chicago, and other cities.

REPORT OF THE STATE BOARD OF HEALTH ON THE EPIDEMIC OF DIPHTHERIA IN FREDERICK CITY, MARYLAND. By C. W. Chancellor, M.D., Secretary. Baltimore.

The aim of the inquiry here reported upon was not merely the abatement of the epidemic, but also such a study of the conditions which invited and made it possible or might contribute to the general sanitation of the State. There is reason to fear that many towns, naturally as favorably situated for health as Frederick City is, are more or less rapidly preparing for a similar scourge by a general neglect of sanitary precautions.

WHITEHEAD'S AMERICAN PASTRY COOK. By Jessup Whitehead. Chicago: National Hotel Reporter. Cloth. $2.

Contains 814 tried receipts, plainly worded and given so fully and explicitly that there should be no failure or even uncertainty in following directions. It is more comprehensive than the title indicates, covering, in addition to fine pastries, ices, creams, and dessert dishes in general, puddings, souffles, and meringues; breads and cakes, and salads and cold dishes.

A FAMILY FLIGHT THROUGH FRANCE, GERMANY, NORWAY, AND SWITZERLAND. By Rev. E. E. Hale and Miss Susan Hale.

ALL ABOARD FOR SUNRISE LANDS. By Edward A. Rand. Boston: D. Lothrop & Co.

Two books of juvenile travel, profusely illustrated, and likely to be attractive to young readers, who will not suspect that the travels were invented to furnish a thread for stringing a multitude of pictures unless they happen to get both books at once and see the same cuts doing service in opposite parts of the world.

WHAT IS BRIGHT'S DISEASE? ITS CURABILITY. By Seth Pancoast, M.D. Philadelphia: The Author. $1.

According to Dr. Pancoast's view Bright's disease involves not the kidneys alone but the heart, lungs, and liver also, and the disease may exist for months before albumen can be detected in the urine. The "disease is due to an ennervation of the nervo-vital energy." The first step toward cure is to correct or replace by normal action "the ennervation of the vital energy centered in the organic nervous system." The curability of the disease under timely and proper treatment is strongly insisted upon.

THE CENTURY MAGAZINE. New York, 1882. The Century Company. Publishers, Union Square. Price $3.50.

The first bound volume of this splendid periodical (formerly Scribner's Magazine) presents a most attractive appearance so far as typography is concerned, while the contents are in the highest degree valuable. The volume contains over one thousand pages of fresh and interesting matter, adorned by hundreds of original engravings, embracing novels, short stories, poetry, essays, biography, travels, literary reviews, scientific notes, etc. Several excellent improvements in the typography of the magazine have been added and the pages have been enlarged. The circulation of the magazine has risen from 120,000 to 134,000, which shows that the public recognizes the value of the work.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) L. K. B. writes: I send you to-day by mail a piece of lead pipe, laid about ten years ago some three feet underground; the soil from which this piece came being "made ground" principally, as the pipe was laid under railroad tracks. Will you kindly inform me through the columns of the SCIENTIFIC AMERICAN (to which I am a subscriber), to what causes the holes in the pipe are to be attributed? A. The corrosion of the lead pipe was probably due to the action of water charged with carbonic acid.

(2) P. H. writes: I have seen the colors in woolen goods tested by soaking a small piece in a solution or acid of some kind, the test showing what the colors would fade to if exposed to the sun. Can you tell me what the acid or solution is? A. It is probably a solution of an alkaline sulphite slightly acetified with oxalic acid. It could be ascertained definitely by a simple chemical analysis.

(3) T. W. says: I have a piece of carving in Babbitt metal, a family relic. I want to fill up the lines with red and black composition, the same as zinc name plates are filled in with. The article must stand the heat of summer sun. A. For red filling: Mix with thick copal varnish enough vermilion to produce a thin paste. For black: use ordinary black japan mixed with a little ivory black. Apply with a small spatula, moistened with oil of turpentine, and let the composition dry thoroughly before dressing.

(4) F. W. asks: Will you please describe the method of taking copies by the blue process? I notice in your issue of April 15, how to prepare the paper, but am at a loss to know how to use it. A. Expose the prepared paper under a clear ink tracing (on tracing cloth) or a glass negative, to sunlight for from five minutes to half an hour, according to the strength of the light. Then remove to a dark room, and wash the paper in plenty of running water, and dry in the air.

(5) C. F. B. asks (1) for a simple and good way to soften steel hammers for drilling the handle holes. A. Heat them uniformly to a cherry red heat, and bury them in dry wood ashes, or better, pulverized charcoal, and let them remain till cold. 2. What is the best way to clean a vertical tubular steam boiler, about 9 feet high, 4 feet diameter, with 61 tubes inside? A. If you wish to clean the fire side of the tubes, use a wire brush or scraper; if the water side, it will depend upon the deposit. If you could empty the boiler of water, close it tight, and admit steam from another boiler; after a few hours the scale will rot and fall off. You must then use suitable means or tools to draw the scale from the boiler.

(6) A. S. asks: 1. What constitutes the strength of the electro magnet? A. It is not definitely known. 2. Does more wire on the spool make it stronger, or does the size of the iron core make the strength, the electric power being the same? A. The magnetic strength of an electro magnet depends upon the size of the iron core, the number of turns of wire surrounding it, and the strength of current charging the wire of this helix. In practice these helices are seldom wound to a diameter exceeding three times the diameter of the core, as what is thereby gained in magnetic moment is more than lost in increased resistance of helix circuit. 3. Would two electro-magnets with a wire spool in each of the four helices equal in thickness to the diameter of the iron core, attract each other with greater force than one of them would attract an armature? A. Yes, if unlike poles were opposed. 4. Would one electro-magnet, as per question three, be as strong or stronger than both if the wire in the first instance on the two were placed on only one? A. If the same current were employed, no. 5. Would the strength of the magnet be enhanced by enlarging the ends of the wire core? A. As we understand you, no. 6. Would an electro-magnet be made stronger by using several soft inner magnets in one? A. The advantage of this arrangement would not be great.

(7) S. P. G. writes: I want to make carbons for a Bunsen battery. I have tried gas coke pounded fine and mixed with treacle, then pressed in an iron mould and burnt, but when cooled and removed from mould, are lighter in weight, and crumble away if pressed in the hand, compared to those one buys. Please inform me what are the ingredients of such carbons, how are the ingredients mixed, and after mixture what process do they undergo? Are they pressed and heated (burned)? If so, to what extent? A. In the preparation of ordinary battery carbons it has lately been the practice to use gas tar as the cementing substance instead of saccharine matters, etc. The gas carbon is reduced to a powder, and this is uniformly mixed together with just enough of the tar to make a stiff smooth paste. The paste (or dough) is forced into the moulds under considerable pressure, then heated slowly at first, and finally at very bright redness. When cooled the plates are put to soak in a gas tar liquid and afterwards rebaked. They can by these means be made very dense and hard.

(8) B. B. asks: Is there any process by which rather thick paper can be rendered transparent? A. It can be rendered quite translucent by saturating it (while warm) with Canada balsam or castor oil, but we know of no process of treatment whereby it can be made transparent.

(9) L. G. C. writes: I have tried to make a plain gold ring out of an old watch case and broken jewelry, using a mould made of black lead crucible, in two pieces, counter bored in each half to form a cavity the shape I want for a ring, but I can't get the gold to flow so as to fill the mould. I have tried the gold at different degrees of heat, and tried the mould hot and cold. Is there anything I can melt with the gold to make it more of a liquid? A. Your gate is too small and not high enough to give pressure to the flowing metal. If the two parts of the mould are rubbed together very close, the air cannot get out. Clamp them very lightly or cut air vents from the outside of the ring toward the top of the mould. A few drops of oil will make the casting run clean. Put a little flux of soda or borax in the crucible to clear the metal. Heat is all that is required to make the metal liquid. Moulds of soapstone are in common use among jewelers for plain work, and fine sand moulds for pattern work.

(10) J. H. G. says, in answer D. McF. (page 251, No. 12): If he will keep the cloth well dampened with a sponge ahead of his colors all the difficulties will be removed no matter how the color is mixed.

(11) B. H., Jr., of Texas, asks how or where he can find a description of the process of extracting oil from lemon peel. A. Consult U. S. and German Pharmacopœias; also Spons' "Cyclopedia of Arts" (last edition).

(12) W. P. H. writes: I am using Venetian red paint on wood bowls designed for and covered with rustic work such as hanging baskets, etc. The paint is usually mixed with water for cheapness, but what is better is stale beer. I use it, but neither of above satisfies me, as it does not adhere, but comes off when the bowl is struck, dust fashion. We varnish afterwards, and that aids some in holding in place. Also, how can I get something cheap to varnish the goods with? Cheap varnish is all the goods can stand, in cost say about a dollar a gallon is what is used, but it never dries. I have thought polish of some kind could be produced cheaper. A. Try water glass as a vehicle for your colors (see page 16, vol. xlv.). A cheap shellac varnish is prepared by dissolving six parts of shellac and one of borax in a small quantity of boiling water. Shellac dissolved in wood naphtha also constitutes a good cheap varnish.

(13) J. M. J. asks if a ¾ inch nut is large enough to hold a 50 inch saw on the arbor; the arbor is 2 inches where the saw goes on. A. The thread on the arbor should be as large as possible, 8 or 10 threads to the inch, 1½ inches thick, with a heavy washer between it and the saw. Both collar and washer should be as large as possible without interfering with the requirements of work to be done. The thread in nut and on arbor should be either right or left, so that any tendency of the saw to slip would screw the nut tighter, according to the way in which you wish the saw to run. Two other ways are used in fastening the washer and saw so as not to turn: key the washer, or put two pins through washer, saw, and collar.

(14) H. F. F. asks: Can you tell me of any solution that will change cast iron in appearance so it will look like brass or green bronze? A. See "Electro-brassing and Bronzing," in SUPPLEMENT, No. 316.

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(15) E. McL. asks: 1. Is there anything cheaper than alcohol which is suitable for chemical manipulations—for burning in lamp? A. Methylic alcohol or crude wood naphtha is much cheaper and quite as useful.

(16) A. F. asks: Will you please inform me through your paper what preparation is used by map makers to cover the brass plate before immersing same in battery in order to produce lines in relief? A. The varnish used is a solution of purified asphaltum in naphtha. Ordinary black japan is also employed.

(17) E. K. asks: 1. What could I mix with spelter for castings so as to make it less brittle? A. Use about five per cent of tin and two per cent of copper as alloy. 2. Referring to description of telescope, SUPPLEMENT, No. 252, what is understood by achromatic object glass? A. The form of the ordinary convex lens is such as to cause a slight decomposition of the rays passing through it, making the outlines of objects when viewed throngh it more or less indistinct or colored. These lenses, when *corrected for color* by the superposition of properly ground concavo-convex glasses, are called achromatic or color free.

(18) O. L. C. asks: 1. What proportion in bulk should the quantity of black oxide of manganese bear to the finely pounded carbon, as used in manganese batteries, to procure the best results? A. About one of carbon to one and three-fifths of manganese oxide. 2. How long should a good manganese battery last, allowing the sal-ammoniac solution is renewed as its strength weakens, if the bell the battery rings is rung, say, 100 times per day for two or three seconds each time—the battery to consist of two cells of the battery? A. At least four months, if the connections are perfect.

(19) F. S. W. asks: 1. Could you give me a good receipt for stove polish, either liquid or solid? A. The best stove polish we know of is pure graphite (blacklead) reduced to an impalpable powder by grinding and sifting. 2. Also a receipt for a starch gloss. I have seen a gloss, and think it is made of borax and starch. Will that give a good gloss? A. See answer to other correspondents, this page. 3. Do you know any good remedy for bedbugs? A. Genuine Persian (Dalmatian) insect powder is effective when properly used. Kerosene oil is also quite serviceable.

(20) C. L. W. asks: Please give me directions for making a paste for fastening photographic prints to cards, one that will not stain the print. A. Use a clear, well boiled, rather stiff starch paste to which has been added a few drops of clove oil. 2. Can the gelatine film be removed from a dry plate negative (after having used it to print with) and the glass recoated and used again? A. Yes. Use strong solution of bichromate of potash acidified with sulphuric acid.

(21) E. T. G. writes: I have dissolved some quicksilver in strong commercial nitric acid, and on standing a day, a quantity of crystals appear in the bottom of the flask. According to U. S. P., nitrate of mercury does not crystallize. Now what have I in the flask? It is not soluble in water, but in strong HNO_3. Please reply in the columns of your paper. A. The crystals are doubtless mercuric and mercurous nitrate and nitrate with probably traces of mercuric chloride. The nitrate is not very soluble.

(22) J. H. Z. asks: Can you tell me how to starch collars, cuffs, etc., so that they will be stiff and glossy, as those you buy at furnishing stores? A. Add to one quart of the well boiled (corn) starch three ounces of water glass, one ounce of gum arabic, and two ounces of loaf sugar. Use a polishing iron.

(23) C. H. W. writes: In using knitting machines I find some yarn breaks, which, if well oiled, works all right; but the oil soils the paper boxes and bands in which the goods are put for sale. Can you tell me of any other method of softening the yarn that will not soil the paper? I have tried soap, but do not succeed with it. A. Have you tried glycerine?

(24) M. I. writes: In order to oxidize the scale in which our castings are packed, we use a solution of NH_4Cl (salammoniac) in water. What chemical action takes place, and where does the oxygen come from? A. Chlorides in aqueous liquids oxidize by virtue of the inclination of their positive element to form hydrates or double salts. In these cases the oxygen is obtained from the water. 2. Can Georgia iron be used for malleable purposes? A. Yes.

(25) D. P. S. asks: 1. Could you tell me of a good grease for greasing cartridges? Have been using beef tallow, but it melts too easy. A. Try pure stearic acid or stearine. 2. Why does an ice boat sail faster than the wind that propels it? A. See pp. 309, 340, and 381, SCIENTIFIC AMERICAN, vol. xlii., and pp. 3402-3, No. 214, and 3496, No. 220, SCIENTIFIC AMERICAN SUPPLEMENT.

(26) E. D. S. asks: Will you please inform me, through the SCIENTIFIC AMERICAN (1), how I can stain a glass lamp chimney green? I have a great deal of writing to do evenings, and it hurts my eyes. A. Try painting the glass with a solution of waterglass (sirupy) stained with chrome green. Let it dry thoroughly before using on the lamp. 2. Would a stained globe do any good? A. Probably.

(27) A. G., Jr., asks: Can you inform me of the composition of the hektograph or gelatin pad? A. Use one ounce best gelatin (softened by soaking over night in a little water) dissolved, by aid of heat over a water bath in about six ounces of purest glycerine. Pour into the pan or mould while hot and let cool before using. It should be heated for an hour or more in the water bath before pouring.

(28) A. H. C. asks: Can you inform me of any process by which I can harden plaster of Paris—that is, to make it hard enough for a mould for metal? A. Use ten per cent of alum in the water used for mixing the plaster. Let the cast set slowly, and when properly set dry it in an oven.

(29) Referring to our answer to D. McF. (page 251, No. 12), S. W. says: Your way of sizing cloth with glue is very good, but I have found that it is easier and better in many cases to mix the colors with shellac varnish (shellac and alcohol) and not size the cloth at all. It makes a clean and better job.

(30) N. E. F. asks: Will distilled water in a boiler foam? If the distilled water is not exposed to the atmosphere at all will it foam sooner than rain water? A. If the distilled water has not been allowed long enough in contact with the air to become properly aerated it will thump and foam on first heating. Ordinarily this will not occur where rain water is used.

(31) W. C. M. asks: Is there any rule laid down for working gears on all kinds of lathe, that is, for cutting (threads?) There is generally an index on all lathes, but I want to be able to understand it without referring to the index. Is there any book on lathe work? A. In a three train gear, where A is the first driver running at the same speed as the spindle, B the carrier or accommodation gear, and C the screw gear, the formula is $\frac{C}{A}$ (number of teeth) × pitch of screw= number of threads to the inch—or reverse if convenient, and multiply the number of teeth in the screw gear by the pitch of the screw, and divide the product by the number of teeth in the driving gear, which will give the number of threads required to the inch. In a four train gear, where A is the first driver running at the same speed as the spindle, B the first receiver, C the second driver (B and C being on the movable stud), D the second receiver running on the leading screw; the formula is $\left.\frac{B \times D}{A \times C}\right\}$ × by the pitch of the screw= the number of threads the lathe will cut to the inch. If (as in some lathes) the first driver runs at one half the speed of the spindle, the last product in both the above trains must be multiplied by 2. The books on lathe work are generally deficient in this essential part. Consult "Designs and Construction in Machine Gearing," by Joynson; also "Screw Cutting Tables," by W. A. Martin, London.

(32) E. F. B. writes: It is said that putting glass jars into cold water will prevent them from cracking when any hot fluid is poured into them, as in canning fruit. Is this correct? A. No. Glass expands when heated, and if heated unequally is liable to break. In a jar of this description it is better to have the outside of the jar quite dry and warm or hot.

(33) A. L. H. asks: What are the rules for proportioning the lenses of a terrestrial eyepiece for a telescope, having given the power required, diameter and focus of the object glass? In the eyepiece described in No. 1 of the SCIENTIFIC AMERICAN SUPPLEMENT (Fig. 3), is the second image, a' b', a magnified image of a b, or are the lenses, r, r', and s, used only to invert the image, a b? I wish to increase a little the power of such an eyepiece. Is it necessary to change all four of the lenses, or only the one nearest the eye? A. The best proportions for focal length of the lenses are 3, 4, 4, 3. The power is about the same as if the outer lenses were used alone, separated half their focal distance. Plano-convex lenses are generally used, although variations from these forms are used by different makers for special reasons, arising from different formulas for correcting both aberrations. The power can be varied slightly by changing the distance of r' and s in Fig. 3, No. 1, SUPPLEMENT. The image, a' b', Fig. 3, as above, may be varied also by varying the distance of 3 and t, but ought not to interfere with the general adjustment for achromatism. The lenses, r and r', are the inverting system.

(34) R. W. asks: Is there a chemical process for distinguishing between the different vegetable fibers? A. Yes; dyes are occasionally advantageously employed for this purpose. See articles on "Fibers," in Wagner's "Chemical Technology."

(35) F. A. L. asks: Can you tell me how to remove rust from tools, such as saws, chisels, etc.? A. If very rusty scour first with emery moistened with sulphuric acid diluted with six volumes of water, rinse, dry, and finish with oil and emery flour.

(36) A. L. W. asks: Can you tell me if there is anything (not costly) in which I can soak silk to remove the color (brown) so that it can be recolored red, or so that it will remain light? A. You can try a strong solution of sulphurous acid in water.

(37) T. H. S. asks if as strong a weld in iron can be made by hydraulic pressure as by hammering. A. Wrought iron can be welded by hydraulic pressure as perfectly as by hammering, provided you make the time of contact as short as it is with the hammer. It is the quick stroke that keeps up the heat on the surface and makes what is called a smooth weld. The slow hydraulic pressure would, no doubt, make the interior contact perfect.

(38) E. H. writes: Having a well protected covered one-inch steam pipe connected at boiler dome (boiler supplying 70 horse power engine, pressure 65 pounds), the pipe is carried about 400 feet; steam is not used constantly; condensation of steam takes place too rapidly at terminus. Would you advise for the steam passing through a worm (12 inches diameter, eight or ten rings) incased in an oven or heater to superheat the steam before utilizing; or do you think it will in any way interfere or endanger working of boiler? A. Steam passing through such a heater would not in any way endanger or interfere with the operation of the boiler.

(39) H. A. B. asks: What is the fastest regular time made by the passenger trains in this country, and also in England? A. From Jersey City to Philadelphia, 90 miles, in 1 hour 50 minutes, and about 54 miles per hour on English fast express. 2. What is the diameter of the driving wheels used upon the passenger engines in England? A. In this country 5½ feet to 6½ feet, and in England 6½ feet to 8 feet. It is claimed that on the West Jersey road 70 miles per hour has been accomplished.

(40) W. G. S. writes: My engine is an upright, and has two cylinders 6½ inches each diameter. The steam supply pipe is only 1¼ inches diameter. I am working with only one cylinder. When both are connected they fill with water from the boiler. Is the steam pipe too small? Would that cause the cylinders to take water? A. The steam pipe would not cause the engine to take water. Probably the steam chamber or capacity of your boiler is too small when using both engines.

(41) H. H. asks: What has been the fastest time made on railroads in Europe, and where? A. London and North Western, 73 miles per hour, and on London and South Eastern, 64 miles per hour.

(42) J. A. writes: In compressing a cubic foot of air at 60° into the space of half a cubic foot, will not its temperature be raised to 120° and its pressure to 15 pounds per square inch, provided there be no loss by radiation or otherwise? In short, what is the law of increase of temperature of air by compression, and in contrary its decrease by expansion? Wind power here is cheap, though unsteady, but might it not be utilized by raising heavy weights, and from the slow descent of which, by proper gearing, small but constant power be derived; or might not stout coiled springs be used instead of weights, if there are any makers of such machinery or any known records of attempts in that line? A. Air compressed at 60°, two vols. into one, takes a theoretical temperature of 192° and a pressure of 20 pounds per square inch; falling upon cooling to its normal temperature to 15 pounds pressure where provision is made for cooling the air in the pump and discharge pipe, the pressure will be 4 volumes to 1=30 pounds, 8 volumes to 1=60 pounds, and so on. The contrary effect takes place when compressed air is expanded from some normal temperature (say 60°), with variations in practice resulting from the absorption of heat by the surrounding material at the instant of expansion.

The decrease of heat from 60° when one vol. is expanded to	1½	vols.,	64°
"	"	2	" 104°
"	"	3	" 155°
"	"	5	" 210°
"	"	10	" 279°

or as above, to discharge a constant stream of air from a tank at a temperature of 60°, and under a pressure of 15 pounds, will lower the thermometer at the point of discharge to 40° below zero, outward influences modifying this result somewhat in practice. A constant small power may be utilized from the irregular action of a windmill, by pumping water into a reservoir, or compressing air into cylinders for the purpose of driving a water or air engine; or by the winding up of heavy weights and distributing the power through a train of gearing or pulleys; or by converting the power into electricity and storing it in storage batteries.

(43) W. L. G. asks: Referring to the article on tinning, in SUPPLEMENT, No. 310, is protochloride of tin and muriate of tin crystal or solution, the same article? A. Protochloride of tin or tin salt (stannous chloride) refer to the same salt. It is also occasionally called tin crystal. Tin liquor is stannic chloride, or a mixture of the stannous and stannic chlorides (lower and higher chlorides of tin). 2. What preparation does brass need before dipping? A. Brass may be most readily cleansed for this purpose by first passing it through the hot potash dip, and after rinsing in plenty of cold water, dipping it momentarily in a cold mixture of equal parts of sulphuric and nitric acids and quickly rinsing again.

(44) E. E. O. asks: What circumferential speed will it take to burst a disk of uniform thickness of castiron? of steel? Is the following formula for finding the speed correct? $32\frac{1}{2}\frac{\sqrt{L}}{16\frac{1}{2}}$ in which L equals the length in feet of a bar of uniform size, which will support itself by its tensile strength? A. For cast iron 6,000 feet per minute; for steel, 35,000 feet per minute. The formula that you give is a safe one, as it is about two-thirds the limit given above.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. B. C.—It is a fragment of fluorspar.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 25, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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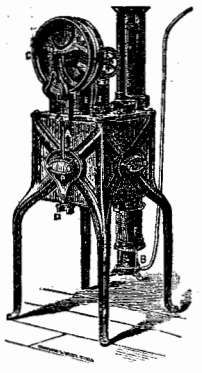

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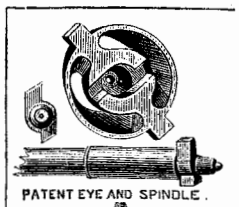
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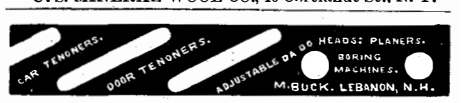

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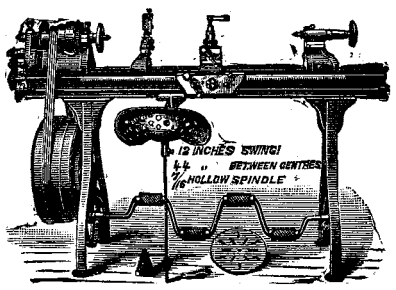

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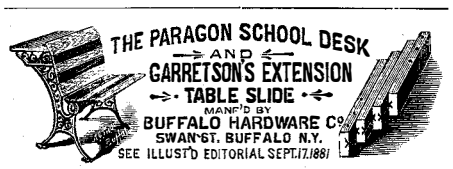

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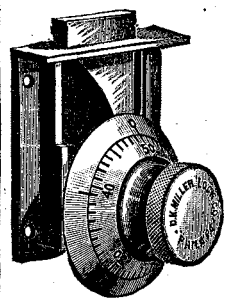

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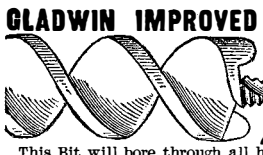

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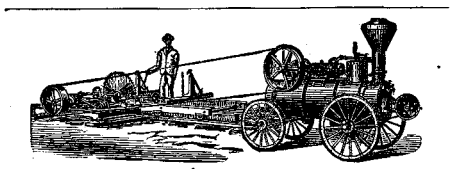

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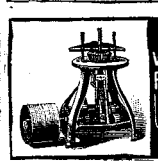

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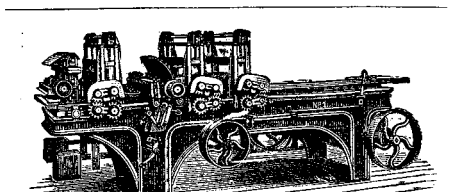

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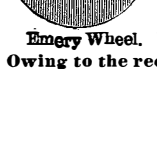

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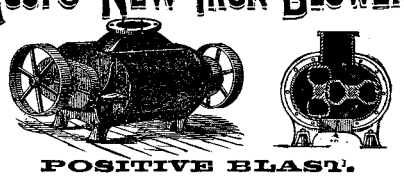

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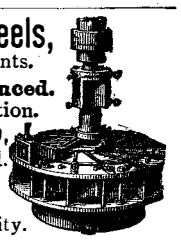

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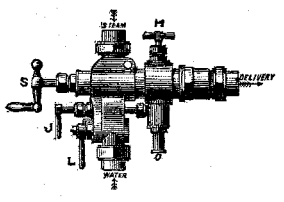

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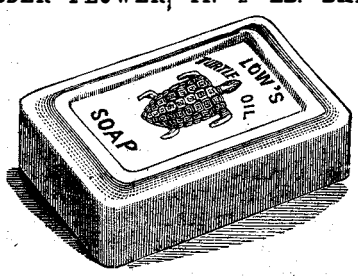

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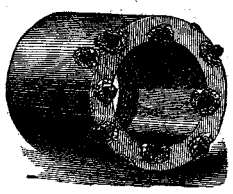

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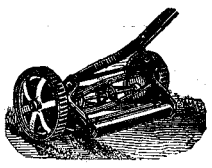

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